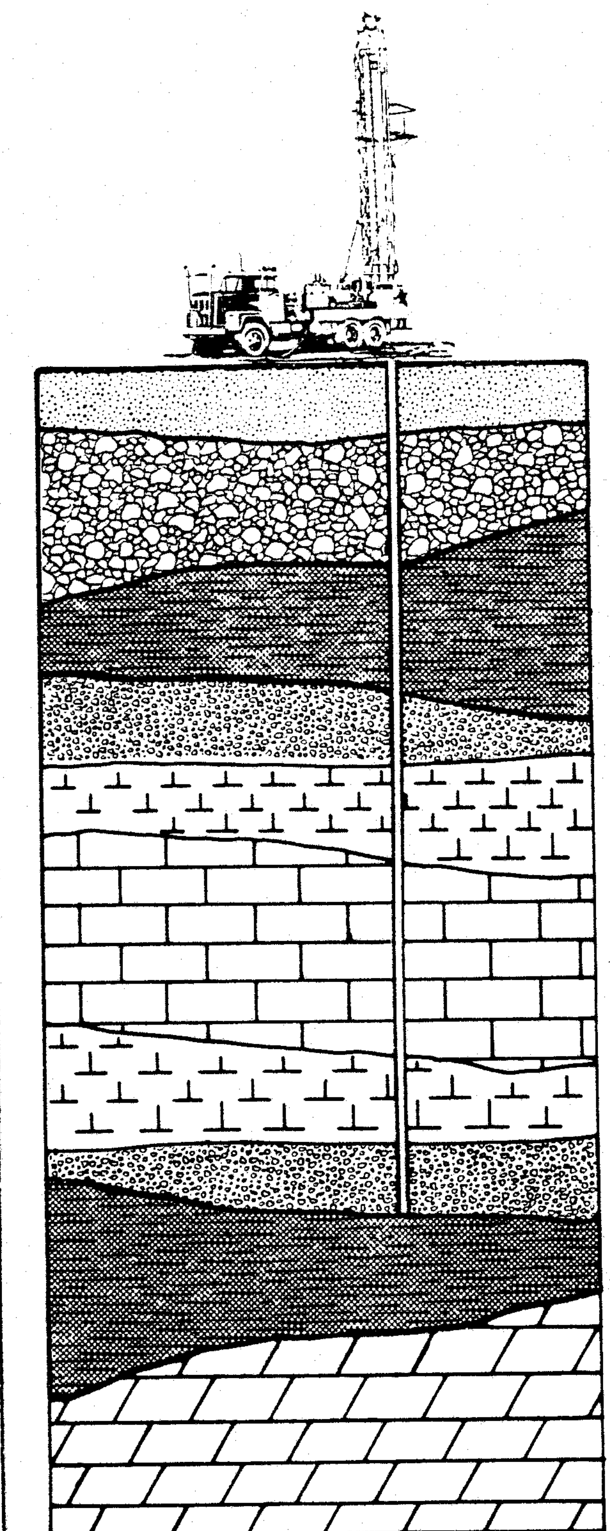


# ROANOKE COUNTY GROUNDWATER

## PRESENT CONDITIONS AND PROSPECTS


by

N. K. Breeding, Jr.

and

J. W. Dawson

WEST-CENTRAL REGIONAL OFFICE



COMMONWEALTH OF VIRGINIA

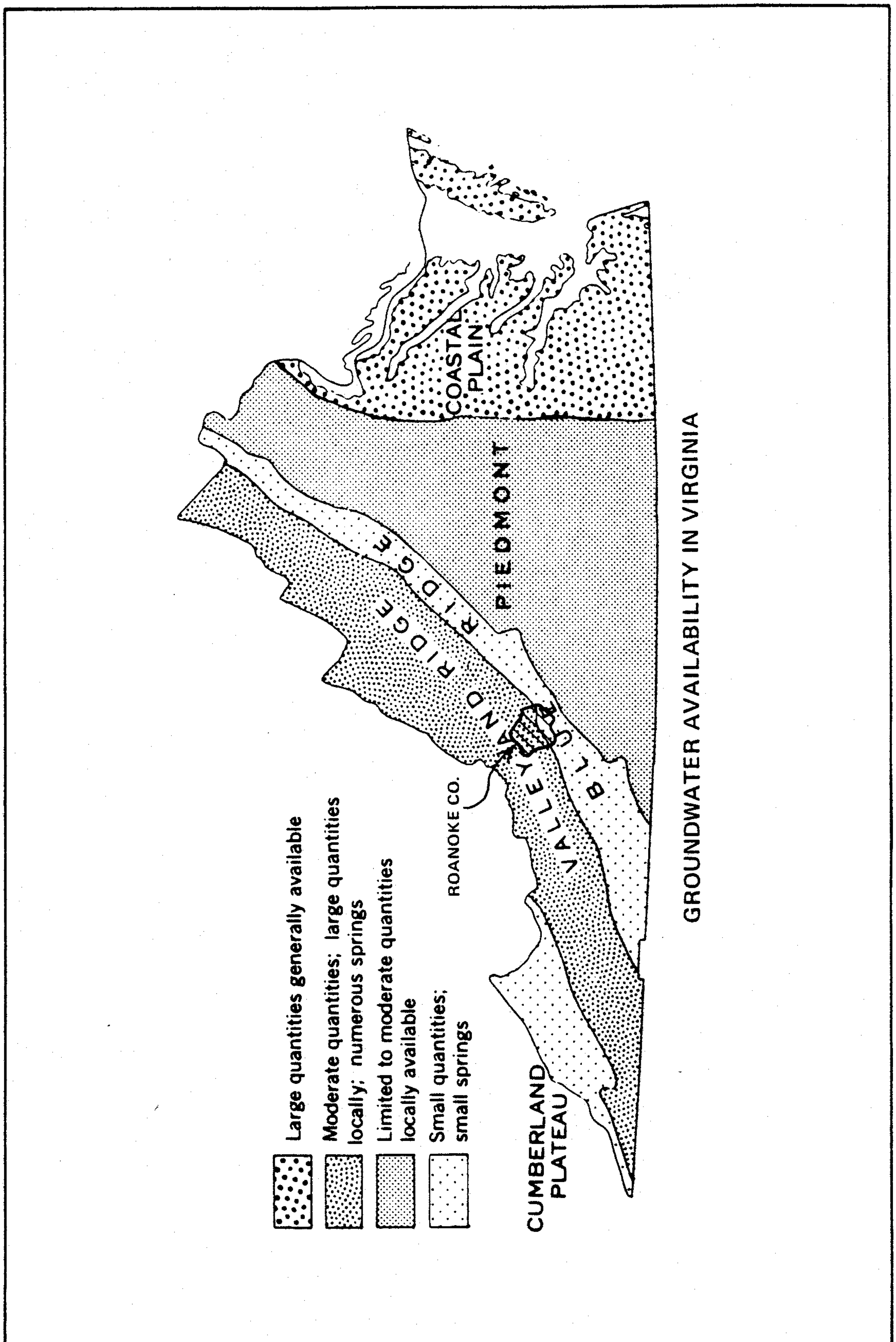
STATE WATER CONTROL BOARD

BUREAU OF WATER CONTROL MANAGEMENT

Richmond, Virginia

Planning Bulletin 301

July 1976



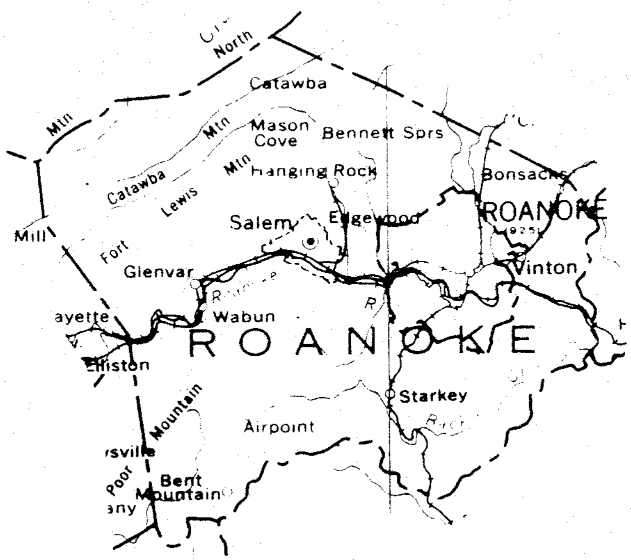
GROUNDWATER AVAILABILITY IN VIRGINIA

Source: Virginia State Water Control Board — BWCM

Frontispiece

ROANOKE COUNTY GROUNDWATER

Present Conditions and Prospects





by
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VIRGINIA STATE WATER CONTROL BOARD
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Richmond, Virginia

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# FOREWORD

This report is part of a series intended to cover the entire State, and to provide private citizens, groundwater users, developers, investors, well drilling contractors, consultants and professionals, and government officials with as complete a picture as possible of the groundwater situation, including prospects, as it exists in each of the counties of Virginia.

On the basis of this report, prospective groundwater users and anyone else interested in the development and protection of that invaluable resource that is groundwater can make up their mind and call a consulting hydrogeologist to handle their specific groundwater problem, while the State Water Control Board remains at the public's service for general information and governmental action.

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## ABSTRACT

Roanoke County is situated in a mountainous area that has undergone numerous geologic processes which have resulted in complex geologic conditions. Intensively folded and faulted sedimentary rocks comprised mainly of shale, sandstone and limestone, and igneous and metamorphic rocks underlie the County. In addition to valuable water-bearing alluvium of stream valleys, three aquifer systems have been identified, which provide about 10 million gallons per day of groundwater for public and industrial use. These aquifer systems have the potential to supply three times as much groundwater.

The Pre-Cambrian-Cambrian Aquifer System extends throughout the southern and eastern portion of the County. It has fair to good water-bearing characteristics, with local areas of high yields. Groundwater quality is generally excellent. This aquifer supplies about 18 percent of public and industrial groundwater needs in the County, but its potential has barely been tapped.

The Cambrian-Ordovician Aquifer System occurs throughout the County and forms the major valley areas. This aquifer has good to excellent water-bearing properties. The quality of groundwater within this aquifer is generally excellent, but it may be moderately hard in isolated areas. About 80 percent of Roanoke County groundwater needs are met through this aquifer system. The potential for future development is excellent, particularalarily for industrial purposes.

The Mississippian-Devonian-Silurian Aquifer System underlies the western portion of the County. Wells in this system have poor to fair

yields, depending on their topographic location. Groundwater quality is generally poor to fair, with excessive iron and sulphur common. About two percent of the County groundwater needs are presently met with this aquifer. The potential for future development for public and industrial supplies is generally poor.

Man's activities can have severe and long-lasting effects on the quality of groundwater, and it must be recognized that groundwater is a delicate resource that requires adequate conservation and management if it is to fulfill its role in meeting the demands of the future. Prevention is the key to maintaining groundwater quality because once contaminated it is difficult, if not impossible, to restore it due to the limitations of technology and the cost involved.

# CHAPTER I

# INTRODUCTION

## General Setting

Roanoke County, encompassing approximately 277 square miles, is located in west central Virginia (Plate 1), rural in nature, with agriculture and livestock production accounting for most of the land use in the County.

The cities of Roanoke and Salem, and the town of Vinton comprise the major urban area of the County, all of which are situated in the Roanoke Valley. According to the Division of State Planning and Community Affairs, the total population of the County in January 1976 was 67,000, while Roanoke, Salem and Vinton had populations of 105,000, 22,000 and 7,400 respectively. Growth in the County has been centered in the Roanoke Valley and the population of the Roanoke Metropolitan Area has increased from 158,803 in 1960 to its present level of 201,400 and is expected to increase to 207,700 by 1980, 236,200 by 1990 and 264,700 by the year 2000.

Water needs are primarily being served by surface water from the Roanoke River and the Carvins Cove Reservoir, with groundwater supplying about 33 percent of the total water demand. However, as water demands by individuals, municipalities and industries increase, groundwater should be viewed as an attractive resource because of its high quality and good availability as well as its cost efficiency.

Current information indicates that about 10.5 million gallons per day (MGD) of groundwater is used in the County, while information on completed wells indicates that approximately 30 MGD of groundwater could be obtained from present wells, if so desired.

## Purpose and Scope

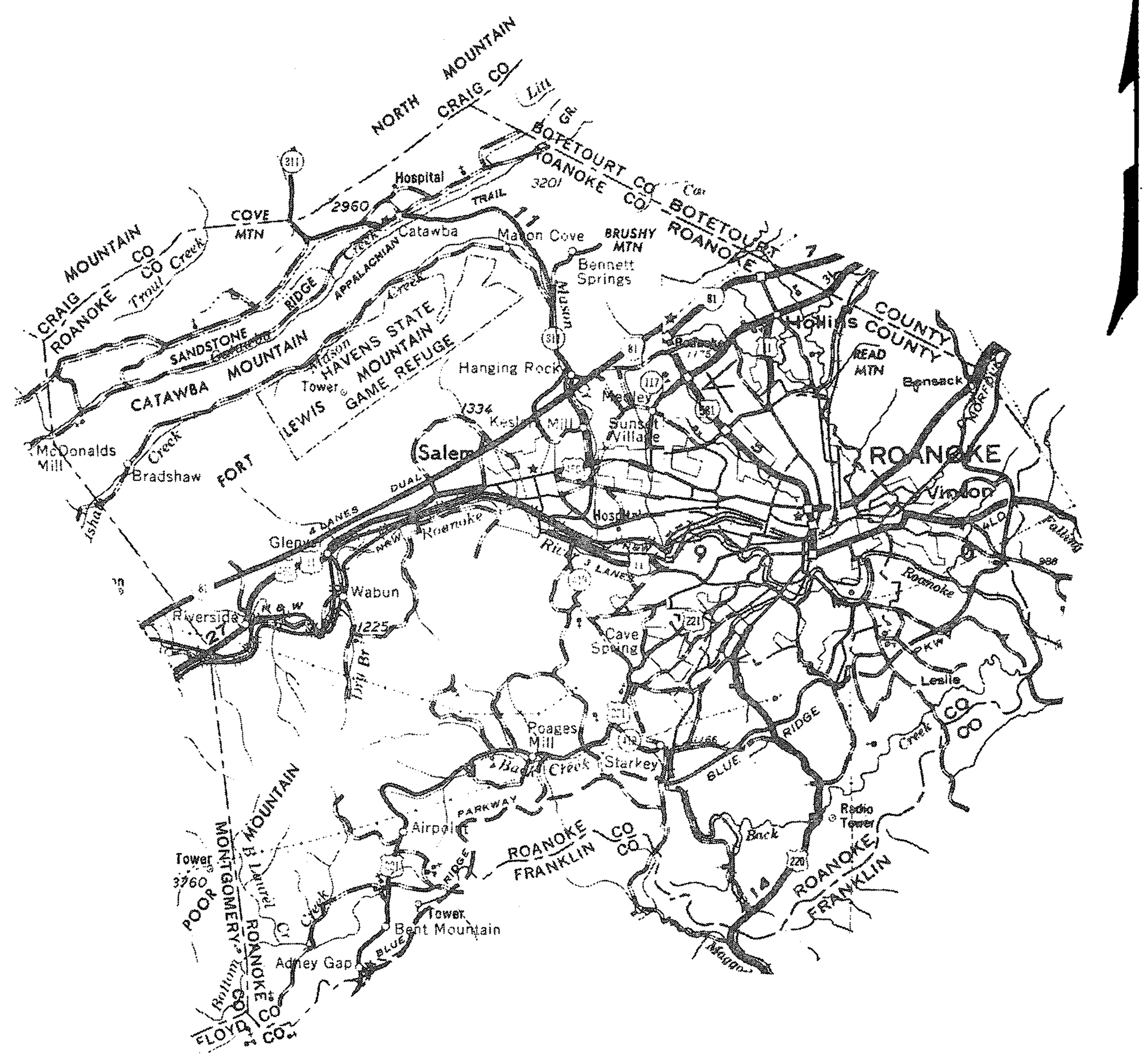
The purpose of this report is to consolidate available information on groundwater in Roanoke County, to provide individuals, industries, and municipalities with a picture of the groundwater resources in the County, and to describe how these resources may be developed to meet the present and future needs of the County. Although directed towards the laymen, this report is also intended to provide a background for more professionally oriented readers.

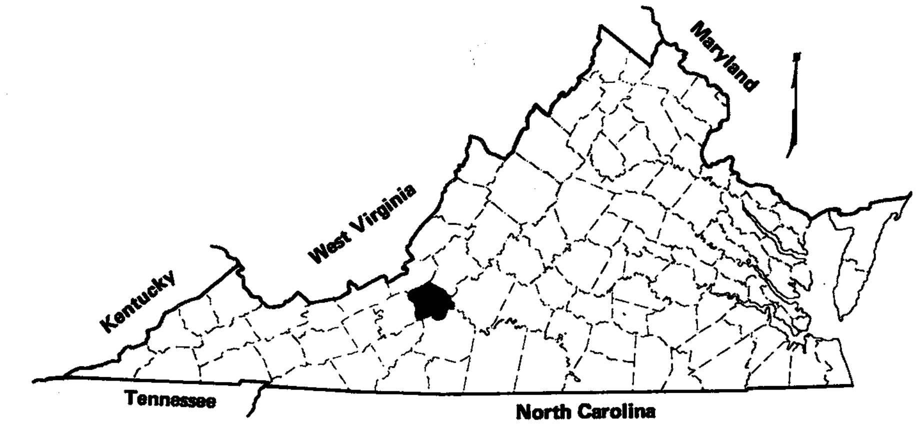
## Methods of Investigation

Most of the general background and geologic information appearing in this report is a summary of previous work. Some of the information on water well construction and groundwater quality has been obtained from other State Agencies, although the bulk of it has been collected by the State Water Control Board.

Much of the previously unpublished information on individual well construction data and quality analyses has been collected as a result of the Groundwater Act of 1973. This Act requires that drilling contractors submit a Water Well Completion Report (From GW-2) for all wells drilled, and that owners of industrial and public water supplies submit quarterly reports (Form GW-6, Groundwater Pumpage and Use) detailing groundwater withdrawal. In addition, the Board requires that drillers submit drill cutting samples collected at ten-foot intervals on all public and industrial supply water wells and those wells which are drilled to unusual depths or are located in areas deemed deficient in geologic information.

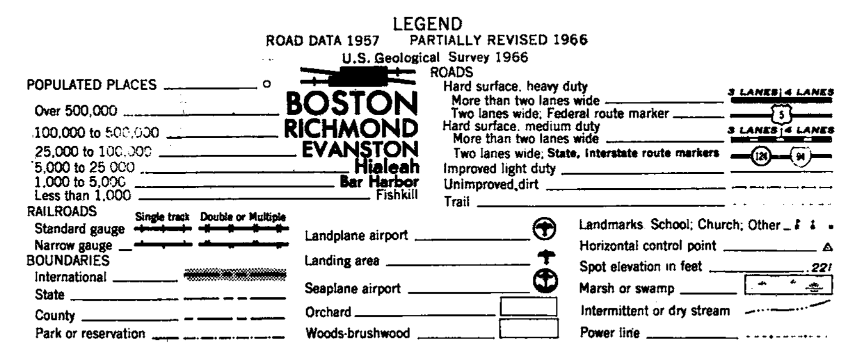
# INDEX MAP OF ROANOKE COUNTY




POPULATION (1976 projections)
County: 67,000
Roanoke: 105,000
Salem: 22,600
Vinton: 7,400

AREA
Square Miles: 277

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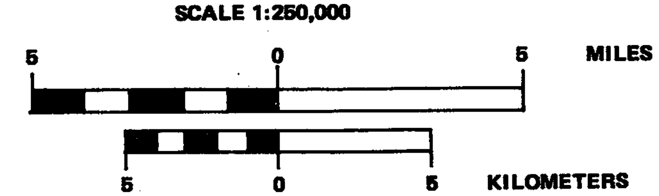



Source: Virginia State Water Control Board — WCRO

PLATE NO. 1

A concentrated effort has been made over the past year to gather information relating to groundwater quality trends in Roanoke County. In addition to specific sampling areas, groundwater quality information is obtained from regular monthly sampling runs made by the Board's West Central Regional Office. Domestic supplies are generally sampled although some small industrial and commercial supplies are checked occasionally.

Another source of quality information is the Pollution Response Program (PReP), maintained by the Board for the sole purpose of responding to citizen reports of water pollution of any type. This includes pollution of both groundwater and surface water by accidental or intentional spills of hazardous chemicals, oil, gasoline, refuse and industrial wastes.

All well information, well completion reports and records of groundwater quality analyses cited in this report are on permanent file at the Board's Headquarters Office in Richmond and the West Central Regional Office in Roanoke. These data are computerized for storage and retrieval, and were used to compile Appendices A and B.

## Previous Investigations

Several geologic investigations have been made of the Roanoke area, which include part or all of the counties of Roanoke, Botetourt, Bedford, Craig and Montgomery. The earliest geological investigations for iron and manganese ore along the foot of the Blue Ridge Mountains were by Watson (1907), Harder (1908, 1909) and by Stose, et. al. (1919). Later Woodward (1932) and Butts (1933) presented the results of two geological investigations that encompass maps delineating various geological units. More specific and recent reports of the geology of the area have been conducted by Butts (1940), Andrews (1952), Dennison (1956), Chen (1959), Hergenroder (1966) and Walker (1966). Recently, Amato (1974) did detailed geologic mapping of the Salem Quadrangle at a scale of 1:24,000.

Groundwater characteristics of the area were summarized by Latta (1956) and included a compilation of water well data. The most recent work, by Waller, (unpublished Ph.D. dissertation, and State Water Control Board report, 1976) is a comprehensive study of the water resources of the Upper Roanoke River Basin, emphasizing aquifers and groundwater in Roanoke County and part of Botetourt, Floyd and mainly Montgomery Counties.

## Water Well Numbering System

The State Water Control Board's Bureau of Water Control Management maintains water well information such as well depth, size and yield, and other pertinent data in a computerized system at the Board's Richmond headquarters; also, information on water quality and water level changes is computer-maintained at Richmond by the Board's Bureau of Surveillance and Field Studies. Retrieval of this information for specific wells is possible by the water well numbering system.

This system comprises two numbers: the first one is a county identity number (Roanoke County is 180), and the second number is a sequential listing of wells in the county. For example, well number 180-349 refers to a specific well in Roanoke County. At the time of this report, over 400 wells are listed in the file for this County, although it is estimated that the total number of wells in the County is substantially higher.

## Acknowledgements

Appreciation is expressed to the citizens of Roanoke County, cities of Roanoke and Salem, and the town of Vinton who furnished information on their wells and who permitted water quality samples to be taken. The

officials of the aforementioned municipalities were most cooperative in supplying information on public water supply wells, as was the Bureau of Sanitary Engineering of the State Department of Health, in furnishing copies of chemical analyses of these wells. Several water well contractors who operate in the County deserve thanks for supplying valuable information on construction characteristics and well data. Appreciation is extended to the Division of Mineral Resources and the Soil Conservation Service for information in regards to geology and soils.

# CHAPTER II

# PHYSICAL SETTING

## Physiography

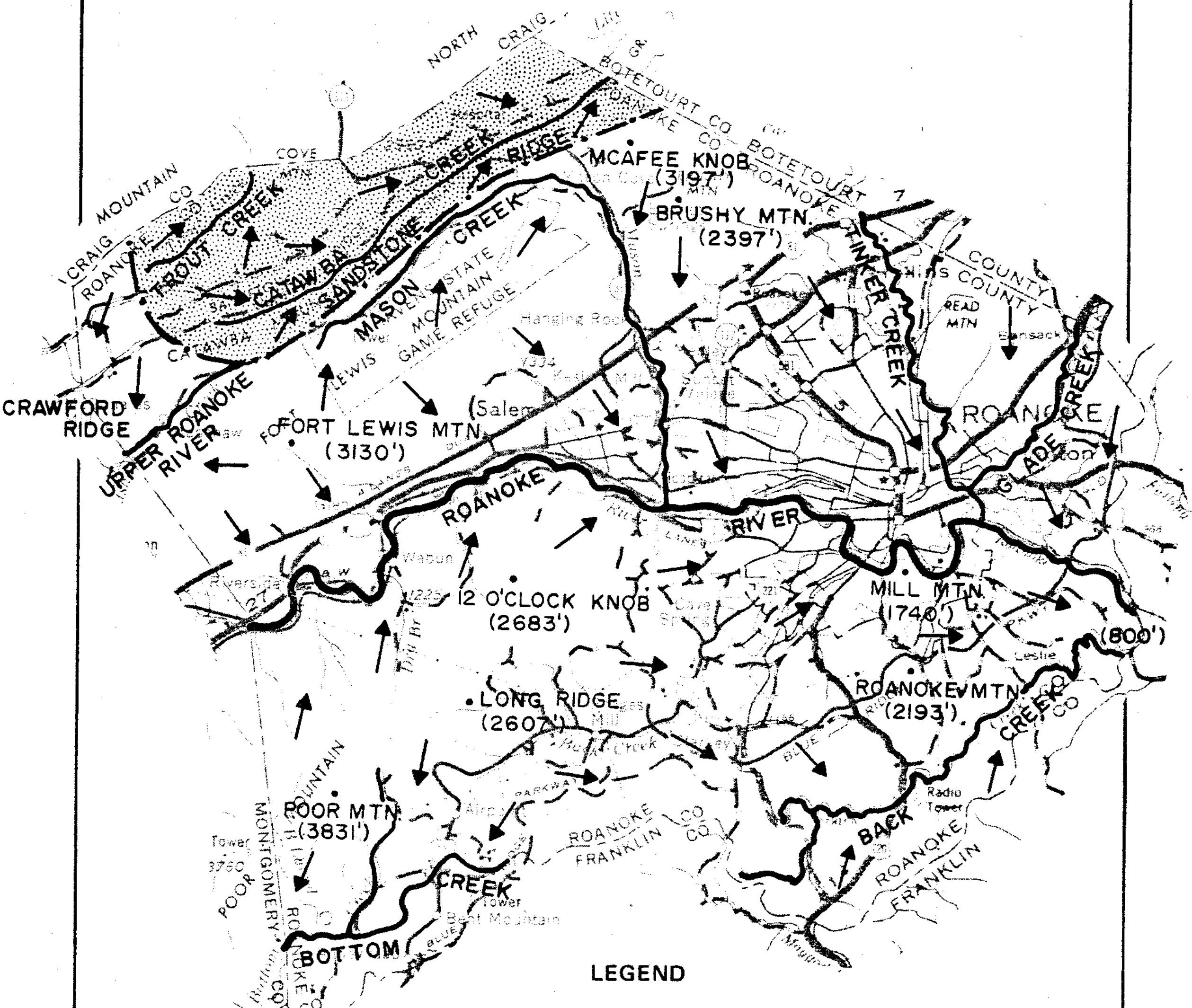
Roanoke County lies within the Blue Ridge and the Valley and Ridge Physiographic Provinces. Locally, the physiographic units include the (1) Blue Ridge Mountains along the southeastern portions of the County; (2) Fort Lewis-Brushy Mountain-Catawba Valley Complex of the Valley and Ridge Physiographic Province in the northwestern area of the County; and (3) Roanoke Valley which is broad and flat and comprises the central and northeastern portions of the County.

The major topographic features of the County exhibit approximately 3,000 feet of relief between the summit of Poor Mountain (3,381 feet) and the Roanoke River where it exits the County (800 feet) near its confluence with Back Creek (Plate 2). The southeastern portion of the County is characterized by forested mountains intersected by narrow, steep-sided ravines and valleys. However, the topography of the northwestern area of the County is markedly different, characterized by the long, narrow, parallel, northeast-trending valleys and mountain ridges of the Valley and Ridge Physiographic Province. In general, the mountains in this part of the County are rugged, heavily forested, with numerous small streams dissecting them.

## Hydrology

Most of the County lies within the Roanoke River Basin; however, the area of the County drained by Catawba Creek lies within the James River Basin with the gap between Crawford Ridge and Sandstone Ridge in the northwest part of the County demarking this drainage divide. Carvins

# PHYSICAL SETTING OF ROANOKE COUNTY




LEGEND

River Basin Boundary
Subsurface Drainage (Generalized direction of groundwater movement)
James River Basin
Roanoke River Basin

Source: Virginia State Water Control Board – WCRO

PLATE NO. 2

Creek is impounded to form the largest reservoir with a storage capacity of 6,500 million gallons, and furnishes the major portion of potable water to the city of Roanoke and the town of Vinton. Carvins Cove Reservoir is augmented during times of high flow through inter-basin transfer from the James River Basin.

Several stream flow gauging stations are maintained throughout Roanoke and adjacent counties. The data from these are published annually by the U.S. Geological Survey in "Water Resources Data for Virginia". The extremes of discharge values for the water year of 1974 are shown below:

TABLE 1

EXTREMES VALUES FOR DISCHARGE IN CUBIC FEET PER SECOND

| Station | Flood of Record | Year 1974 Maximum | Year 1974 Minimum |
|---|---|---|---|
| Roanoke River-Lafayette | 24,500 $ft^3/s$ (1972) | 3,860 $ft^3/s$ | 51 $ft^3/s$ |
| Roanoke River at Roanoke | 25,300 $ft^3/s$ (1972) | 4,740 $ft^3/s$ | 58 $ft^3/s$ |
| Tinker Creek near Daleville | 4,000 $ft^3/s$ (1972) | 3,580 $ft^3/s$ | 2.8 $ft^3/s$ |
| Roanoke River at Niagara | 28,800 $ft^3/s$ (1972) | 5,880 $ft^3/s$ | 11 $ft^3/s$ |

## Climate and Precipitation

A relatively mild climate characterizes Roanoke County, hot and humid in summer; cool and rainy in winter, with some snow. The average annual temperature is about 55°degrees Fahrenheit; the hottest month is July with an average temperature of 75°F, and January is the coldest month with an average temperature of 36°F. Precipitation during the warm months (April-September) averages about 23 inches while the fall and winter months experience about 16 inches (some of it snow, but predominately rain), with an average yearly precipitation of about 40 inches.

## Soils and Vegetation

Soils and vegetation influence groundwater conditions and soils are highly dependent on geology. The underlying geology has a significant effect on the properties of soils developed over them, and in view of this, a generalized discussion of soil conditions is presented below. For example, a soil developed on limestone will have a higher clay content than one developed on sandstone. Seventeen major soil associations are recognized in Roanoke County; however, for simplicity they are consolidated in four major types of soils:

Blue Ridge Complex. These soils tend to be deep, well-drained and permeable, located on sloping to steep relief of the mountains. Some shallow, poorly-drained soils are present in the valleys, but their extent is not great. These soils have a large impact on the amount of water allowed to infiltrate into the groundwater regime. Due to their deep nature they act as a sponge, allowing water to continue percolating downward to replenish the groundwater.

Limestone and Dolomite. These soils are mostly deep, moderately well-drained, gently sloping and moderately permeable. Due to the karst nature of the limestone terrain, these soils have a major impact on the groundwater by directing recharge to sinkholes with minimal infiltration through the soil.

Alluvial Sediment (Flood Plain and Terrace Deposits). Soils of this type are well to poorly-drained with moderate to poor permeability on gently sloping to nearly level stream terraces. These deposits can store large volumes of water to replenish the groundwater regime.

Sandstone and Shale. These soils are mostly shallow to moderately deep, well-drained, having moderately high permeability on moderately sloping relief. Soils in this group have little impact on infiltration.

Abundant vegetation is evident in Roanoke County and is a result of the relatively mild climate and sufficient precipitation. Large stands of deciduous and evergreen trees cover the mountain slopes, with valley areas primarily having grass and agriculture crops present. Heavy vegetative cover inhibits surface run-off and subsequently, permits greater amounts of water to seep into the subsurface and replenish the groundwater resource. On the other hand, areas with little vegetative cover (e.g. grass) or cleared areas have higher surface run-off figures and, as a result, less water enters the groundwater regime. As large areas of forest land are cleared and run-off coefficients increase, a decrease in groundwater recharge and a decline in the water table may result.

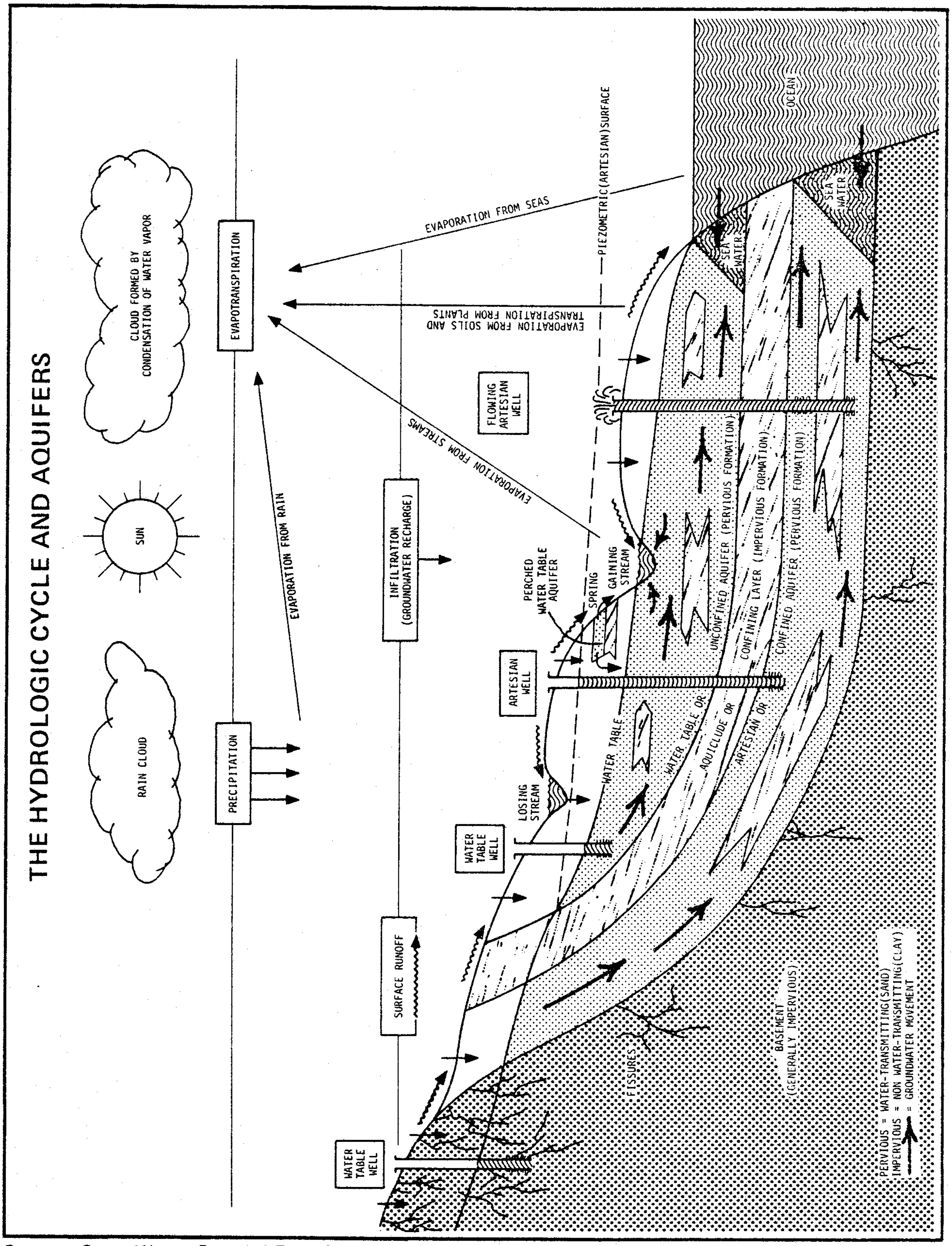
CHAPTER III

HYDROGEOLOGY

## Introduction

There is a strong relationship between the geology and the occurrence, movement and quality of groundwater. Geologic information is a requisite to understanding the hydrogeology of Roanoke County or any area. Many factors control groundwater conditions, the most important being the lithology (types of rocks) and the geologic structure (folds, faults). The ability of different types of rocks to absorb, store and transmit water varies greatly according to their nature. Further, structural deformation undergone by these rocks may either foster or impair groundwater conditions. Rocks which act as a reservoir and allow water to move are termed as aquifers, while those which are not porous and permeable enough to yield water are aquicludes. A generalized diagram of aquifers and the hydrologic cycle, the circulation of water on and below the land surface is shown on Plate 3. Groundwater is constantly moving over extensive distances from areas of recharge to areas of discharge (springs, streams, wells, etc.), but movement is very slow compared with surface water velocities. As water moves underground, it acquires a chemical and physical quality which depends on the type of rocks in which it circulates. For instance, carbonates generally are associated with hard water; sand, gravel, sandstone, and igneous and metamorphic rocks with low content in dissolved solids water, and clayey formations with highly mineralized water. The overall movement of groundwater in Roanoke County is shown on Plate 2. Movement is closely controlled by topography and geology.

The three major rock types (igneous, metamorphic and sedimentary) are present in Roanoke County. Igneous and metamorphic rocks have similar




Source: State Water Control Board - BWCM

PLATE NO. 3

water-bearing properties and make up about 25 percent of the County. The porosity and permeability values are near zero in unweathered granites, gneisses and many other crystalline rocks. However, once geologic processes alter the rocks over long periods of time, there is room for water to occur in fractures, faults, along contacts between the rock types, joints and other small openings. Fractures usually become smaller and fewer with depth. Some of the metamorphic rocks such as phyllite, slate and schist may contain water along the cleavage planes.

Sedimentary rocks form about 75 percent of the rock underlying the County. Water occurs in voids, bedding planes, fractures and solution channels. Limestone and dolomite have highly erratic water-bearing properties. Porosity is frequently moderate or low, but where joints have been enlarged into solution channnels by the dissolving action of water, large volumes of water may be transmitted and stored. Sandstone contains water in pore spaces which are dependent on sorting, grain size, shape, packing, and the degree of cementation. Sandstone cemented with soluble calcite or clay minerals may break down easily and develop high permeability. Some calcareous sandstone formations are excellent aquifers; a sandstone cemented with silica may have practically no permeability unless fractured. Shale has a high porosity, but the permeability is low so that extraction of water from pore spaces is difficult, if not impossible. Small quantities of water may, however, be trapped in and extracted from joints, bedding planes and shaley partings. Clay has hydrologic properties similar to and rather worse than those of shale and is impermeable , i.e. incapable of supplying water to wells. Unconsolidated sand and gravel are highly porous and permeable, and constitute good aquifers.

## Geologic Setting

Roanoke County is uniquely located along what is termed as the "hinge point" between the northern and southern Appalachians. Consequently, the area is very complex, folding and faulting being of major importance in the Valley and Ridge portion of the County (Plate 4).

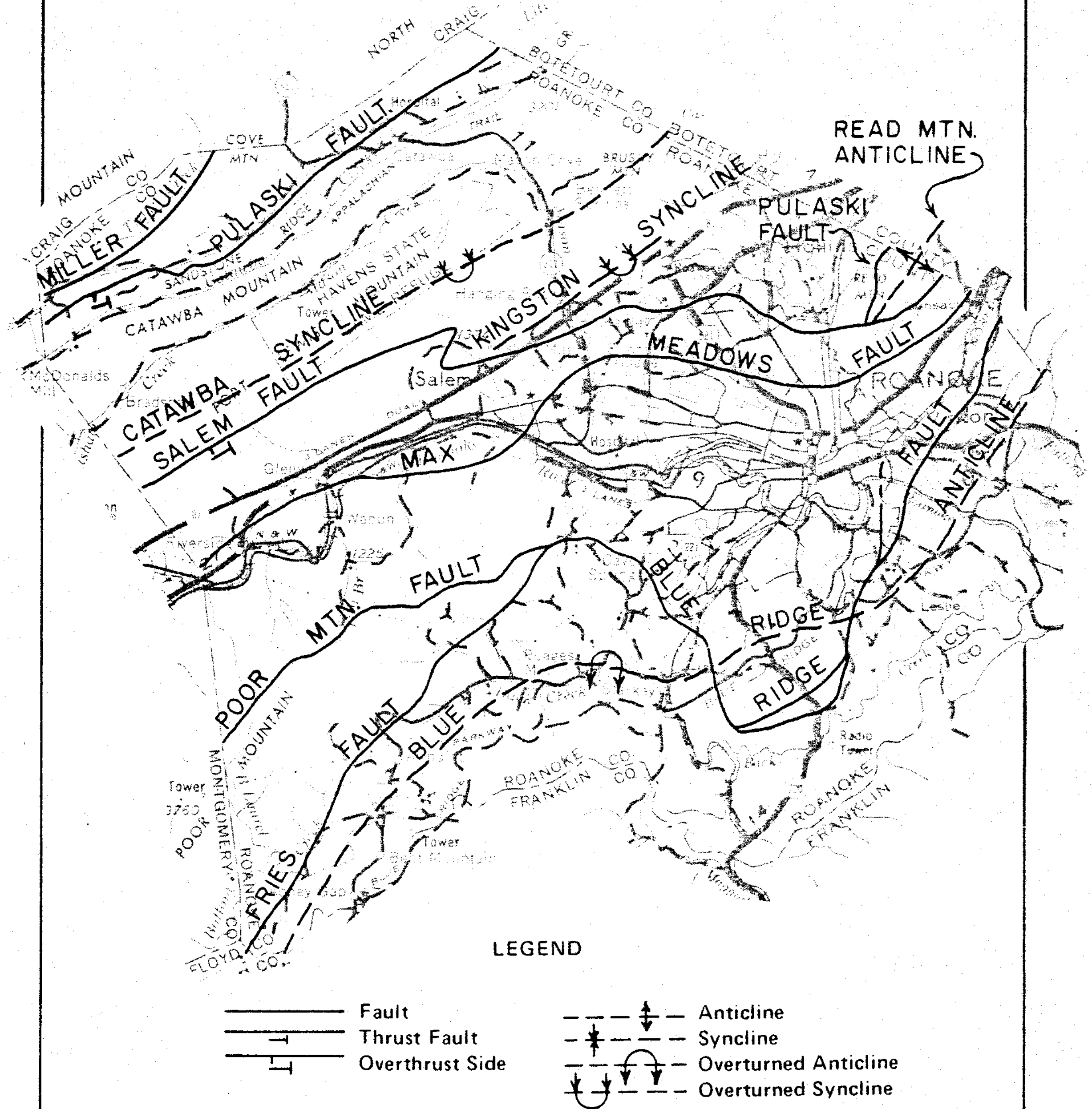
The anticlines and synclines resulting from folding are significant with respect to groundwater; for example, water collected in valleys eroded into anticlines is channeled into the limbs and troughs of the adjoining syncline where it may be under appreciable artesian head (Plate 5). Wells may intercept such water at considerable depths, with water flowing at the surface under artesian conditions (Plate 6). Faults are breaks in the earth's surface along which there has been displacement of rock masses relative to one another. In the Valley and Ridge portion of the County, massive amounts of older rocks have been thrust northwestward over younger rocks. This thrust faulting has created extensive zones of rock breakage and openings in the area of the fault zones and solution action of groundwater further enlarges these openings resulting in favorable conditions for groundwater occurrence, especially in the first 200 to 400 feet below the land surface. The major faults that have an appreciable positive effect on the groundwater conditions in the County are shown on Plate 4.

## Geologic Formations and Groundwater Occurrence

General geology and groundwater conditions introduced above are detailed below in the discussion of groundwater in Roanoke County.

The nomenclature in this report is consistent with that in Report of Investigations 37, for the Salem Quadrangle by Rover V. Amato (1974), published by the Virginia Division of Mineral Resources, and in the Geologic

# MAJOR GEOLOGIC STRUCTURES IN ROANOKE COUNTY




Source: Virginia Division of Mineral Resources

PLATE NO. 4

Map of Virginia at scale 1:500,000 (1963). Symbols for the formations appear in parenthesis after each formation. The locations of the rock formations and their water-bearing properties are shown on Plate 7, while Plate 8 represents three generalized cross-sections of the hydrogeology of the County, with cross section lines indicated on Plate 7. These geologic formations and related groundwater conditions are summarized in Table 2.

Pre-Cambrian and Cambrian (greater than 600 million years old)

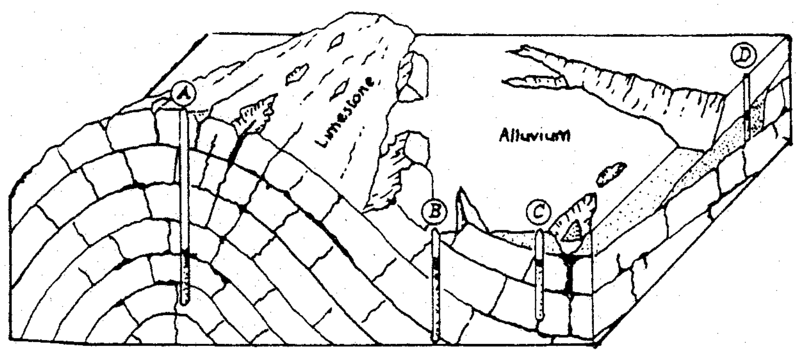
The Blue Ridge Complex (pЄv). This complex is composed of various igneous and metamorphic rocks of Precambrian age which form the core of the Blue Ridge Mountains. These rocks, mainly greenish-gray granite, form the Bent Mountain and Lost Mountain area of the County. Good exposures can be seen in the deeper stream beds along State Route 694 in the vicinity of Twelve O'Clock Knob. The availability of groundwater in this formation is fair to good but varies greatly. Systematic location of wells is necessary to ensure a good yield and reliable source.

The Chilhowie Group (Єch). One of the best ridge markers in the area is the Chilhowie Group. Rocks of this group form the tops of Poor, Roanoke, Mill, Long Ridge, and Fisher View Mountains. They consist predominately of slightly metamorphosed conglomeratic quartzite, sandstone and shale, and constitute a poor aquifer.

Cambrian (500-600 million years)

The Shady Dolomite (ЄS) This grouping is exposed just south of Roanoke in the vicinity of the Rockydale Quarry. It is a massive, coarse-grained dolomite with interbedded shale and clay. There are very few outcrops in the area due to its thick soil cover. The availability

DIAGRAMMATIC SKETCH OF GROUNDWATER OCCURRENCE IN LIMESTONE




Water wells in a region of folded limestone rocks. Dark areas indicate zones with solution openings. Well A is successful but pumping lift is excessive. Well B has a low yield. Well C is successful and has only a small pumping lift. Well D has been developed in alluvium.

Source: Davis and DeWiest, 1966

PLATE NO. 5

NEWLY DRILLED ARTESIAN WELL IN ROANOKE COUNTY

Source Virginia State Water Control Board — WCRO

PLATE NO. 6

of groundwater in this formation is excellent, with high yields frequently encountered.

The Rome Formation (Ꞓr) This formation underlies a large portion of the Valley along the western portion of the Blue Ridge. The Rome is composed of red, green and purple shale which weather to a yellowish-gray color, and interbedded limestone, dolomite and sandstone. Dark red shale is the characteristic rock, but only make up about a third of the exposed formation. The high carbonate content of this formation is responsible for its excellent water-bearing properties in the County.

The Elbrook Formation (Ꞓe). This formation is composed of thin-to-medium bedded dolomite, with some limestone and shale. It occupies a belt west of the Rome Formation, with another outcrop area in the Catawba Valley on the hanging wall of the Pulaski fault. The groundwater availability and reliability is excellent with high yields frequently encountered.

Ordovician (425-500 million years)

The Knox Group (OꞒK) This group consists of the Copper Ridge Dolomite, the Chepultepec Limestone, and the Beckmantown Formation. The Copper Ridge is composed of limestone and dolomite with chert (flint) and some beds of sandstone. The Chepultepec consists of about 150 feet of mostly fine-grained limestone and small amounts of dolomite. The Beckmantown formation is chiefly dolomite with lesser amounts of interbedded limestone and is very cherty. The Knox Group outcrops primarily in the northern portion of the County in a small belt along the western edge of the Catawba Valley. It has excellent water-bearing properties with high yields often encountered.

# HYDROGEOLOGY OF ROANOKE COUNTY


## EXPLANATION

| | FORMATIONS | WATER-BEARING CHARACTERISTICS |
|---|---|---|
| Qsg | QUATERNARY<br>Unconsolidated sand, gravel silt and clay | Good-Excellent |
| Mp | MISSISSIPPIAN PRICE FORMATION<br>Tan-reddish shale and sandstone | Poor-Fair |
| Dch | CHEMUNG FORMATION<br>Brown sandstone, with olive shale | Poor-Fair |
| Db | BRALLIER FORMATION<br>Gray shale with interbedded sandstone | Poor-Fair |
| Dlmu | MILLBORO SHALE<br>NEEDMORE FORMATION<br>HUNTERSVILLE FORMATION<br>Black fissile shale with some siltstone and chert in lower portions | Poor |
| Su | ORISKANY FORMATION<br>White to reddish sandstone | Poor-Fair |
| Omuu | MARTINSBURG FORMATION<br>Shale with some dark limestone<br>BAYS FORMATION<br>Red sandstone and shale | Fair-Good |
| Omu | NEW MARKET LIMESTONE<br>LINCOLNSHIRE<br>EFFNA LIMESTONE<br>FETZER LIMESTONE<br>Gray massive bedded limestone with abundant fossils | Fair-Good |
| Oe | EDINBURG FORMATION<br>Dark gray shale with interbeds of limestone | Good |
| O-Ꞓk | KNOX GROUP<br>Gray dolomite with some limestone.<br>Abundant chert in upper portion | Good-Excellent |
| Ꞓe | ELBROOK FORMATION<br>Gray dolomite and limestone with some green shale | Good-Excellent |
| Ꞓr | ROME FORMATION<br>Red, green, shale and siltstone with beds of limestone | Good-Excellent |
| Ꞓs | SHADY DOLOMITE<br>Coarse grained dolomite with some shale and clay | Good-Excellent |
| Ꞓch | CHILHOWEE GROUP<br>Thin bedded conglomorite, quartzite and shale. Basalt in lower portions | Fair-Good |
| p-Ꞓ | VIRGINIA BLUE RIDGE COMPLEX<br>Greenish-gray gneiss | Fair-Good |
| | THRUST FAULTS | |
| A——A' | CROSS SECTIONS (See Plate No. 8) | |

SCALE 1:250,000

5 0 5 MILES

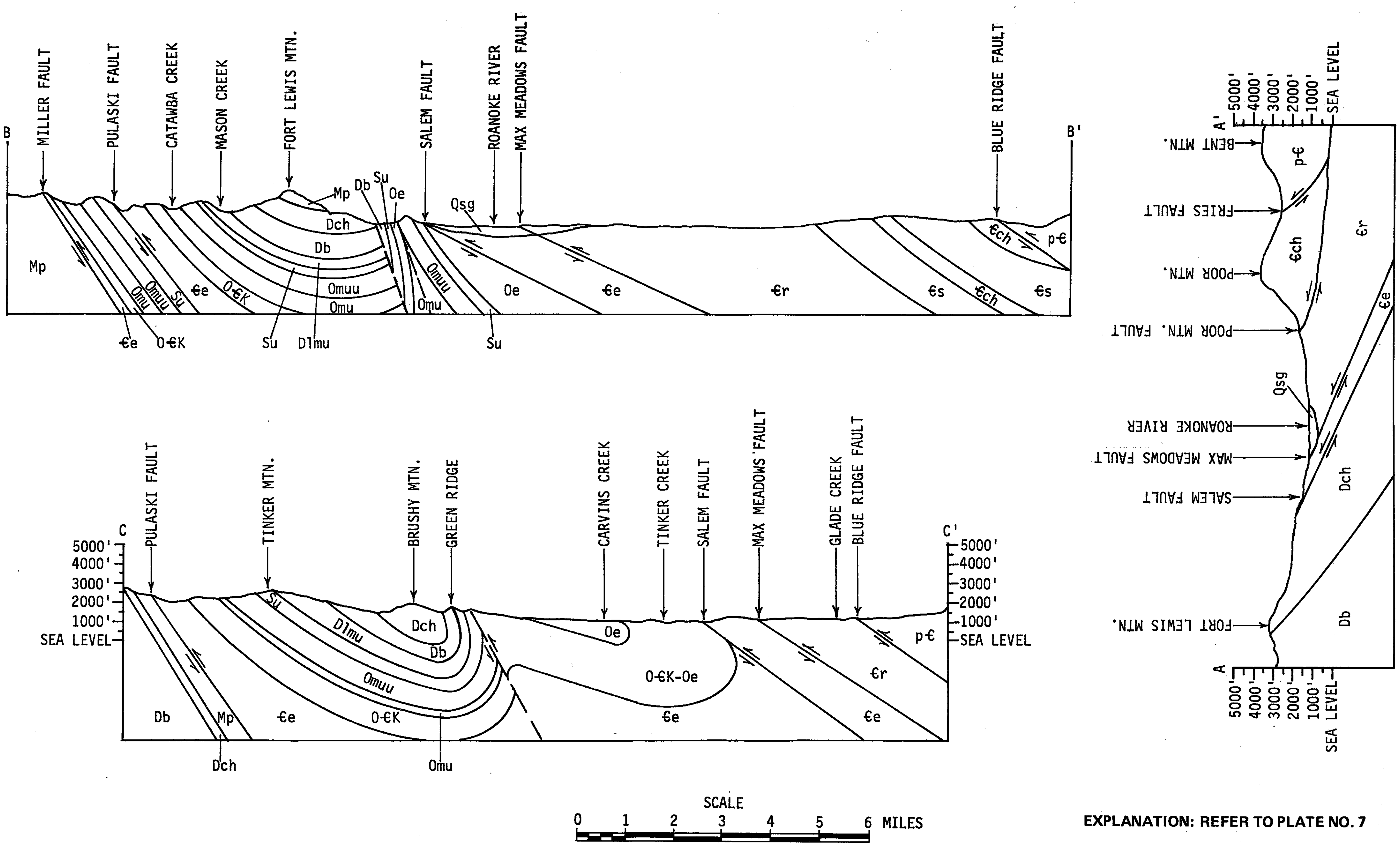
5 0 5 KILOMETERS

Source: Virginia Division of Mineral Resources
Virginia State Water Control Board — WCRO



PLATE NO. 7

# HYDROGEOLOGIC SECTIONS IN ROANOKE COUNTY




EXPLANATION: REFER TO PLATE NO. 7

Source: Virginia Division of Mineral Resources
State Water Control Board — WCRO

TABLE 2

GEOLOGIC FORMATIONS, AQUIFER SYSTEMS, AND THEIR HYDROLOGIC PROPERTIES

IN ROANOKE COUNTY

| System and Age | Formation and Symbol | Lithology (Rock Type) | Thickness in Feet | Aquifer System and Hydrologic Properties |
|---|---|---|---|---|
| Quaternary<br>0-70 million years | Alluvium Qsy | Clay, Silt, Sand and small gravel | 0-30 | Not included as a system<br><br>Water-bearing properties<br>Excellent in Flood Plain Alluvium; poor to fair in Colluvium and higher Terrace Deposits.<br>Flood Plain 100-400 gpm yields<br>Colluvium and Terrace 5-50 gpm<br><br>Groundwater Quality<br>Generally good in Alluvium; Poor in Colluvium and higher Terrace Deposits |
| | Colluvium Qsy | Blocks of sandstone with sand and clay matrix | 0-50 | |
| | Terrace Deposits Qsy | Coarse gravel , sand and clay | 0-50 | |
| Mississippian<br>350 million years | Price Formation Mpr | Tan to light-red sandstone, reddish shales. Lower portion composed of pebbles of white quartz | 200-500 | Mississippian, Devonian, Silurian Aquifer System (MDS-AS)<br>Water-bearing properties<br>Fair - good yields in the valleys; poor yields on the highest ridges 2-50 gpm<br><br>Groundwater Quality<br>Poor - fair especially in the shales large areas of high Iron, and sulphur water |
| | Chemung Formation Dch | Dark brown sandstone with some olive shale | 1000-1500 | |
| | Brallier Formation Db | Grayish shale with interbedded sandstone | 500-1500 | |

TABLE 2 (continued)

| | | | | |
|---|---|---|---|---|
| Devonian<br>400 million years | Millboro Shale Needmore Formation Dlmu | Gray to black fissile shale with some siltstone | 300-500 | |
| | Huntersville Formation Dlmu | Light to gray chert (flint) with some shale | 50± | |
| Silurian<br>440 million years | Sandstone (Keefer S.S.) (Rose Hill S.S.) (Tuscaroora Fm) Su | White to reddish sandstone (S.S.) | | |
| Ordovician<br>500 million years | Martinsburg Formation Omuu | Gray shale with thin-bedded limestone with interbeds of sandstone | 1500± | <u>Cambrian-Ordovician Carbonates Aquifer System (€O-AS)</u><br><u>Water-bearing properties</u><br>Good - excellent for most purposes. When high yields are required, adequate field investigations should be conducted to determine the best water well location and/or well field placement to assure the most efficient development of this aquifer system. Range 15 gpm - 500+ gpm |
| | Bays Formation Omuu | Red sandstone with sparse beds of shale | 40-200 | |
| | Middle Ordovician (New Market) (Lincoln Shire) (Effna Limestone) (Fetzer Limestone) Omu | Gray to dark gray massive bedded limestone. Some beds with abundant fossils | 100 | |
| | Edinburg Formation Oe | Dark gray shale and thin-bedded limestone | 970 | |

TABLE 2 (continued)

| | | | | |
|---|---|---|---|---|
| | Knox Group<br>OЄK | Light gray dolomite with some limestone Upper portion contains abundance of chert. | 1900 | Cambrian-Ordovician Carbonates Aquifer System (ЄO-AS)<br><br>Groundwater quality<br><br>Generally excellent moderately hard, isolated areas contamination induced by man's activities have been delineated. Small isolated areas of high Iron, Sulfate and extremely hard water exist |
| | Elbrook Formation<br>Єe | Medium bedded dolomite with some limestone and green-gray shale | 1000± | |
| | Rome Formation<br>Єr | Red, green, purple shale and siltstone with beds of limestone and dolomite | 2000± | |
| Cambrian | Shady Dolomite<br>Єs | Coarse grained dolomites with some shale and clay | 1500± | |
| | Chilhowie Group (Unicoi Formation)<br>Єch | Thick bedded conglomerate, quartzite, dirty sandstone and shale, the lower portions basalt | 1100± | |
| Pre-Cambrian<br><br>600 million years | Virginia Blue Ridge Complex<br>PЄ | Greenish-gray gneiss resemble granite | ? | Pre-Cambrian Cambrian Rock Aquifer System (PЄЄ-AS)<br><br>Water-bearing properties<br>Poor - good.if wells are accurately located along faults, and fractures, good yields can be had. Poor conditions exist if wells drilled on top of hills.<br>Range 2 gpm - 200 gpm<br>Groundwater quality<br>Excellent; sparse areas of high Iron |

Source: Virginia State Water Control Board - WCRO

The Edinburg Formation (Oe) This formation is exposed in three main belts: a portion of the Catawba Valley, Green Ridge and Little Brushy Mountain areas. It is composed of thick sequences of shale and thin-bedded limestone. The water-bearing properties of this formation are fair to good. Accurate well locations are necessary to obtain good reliable yields.

The Bays Formation (Ob) This formation is located in the Read-Coyner Mountain area and in the southern portions of the County. It is composed of red sandstone with a few shale and coarse-grained, conglomeratic sandstone. The formation has fair water-bearing properties. Very few wells are drilled in this formation.

The Martinsburg Formation (Omb) This formation is exposed in the northern half of the study area. It consists of olive-gray shale with thin-bedded limestone and siltstone. The water-bearing properties of this formation are fair to good; however, incidence of excessive sulfate-bearing water is frequently found.

## Silurian System (405-425 million years) (Su)

The Tuscarora, Rose Hill, and Keefer sandstones are treated as one in this report. They form most of the crests of the ridges in the western portion of the County. Catawba, Paris, Little Brushy, Tinker, and Read Mountains and Green Ridge are some examples within the County where these sandstones are exposed. Very few wells are drilled in this formation, due to its location. The water-bearing properties are expected to be fair to good, but the wells are to be carefully located.

## Devonian System (345-405 million years) (Dlmu) (Db) (Dch)

The Devonian rocks outcrop in the Catawba Syncline forming the majority of the mountains in the western portion of the County; these include Fort Lewis Mountain, Brushy Mountain and Green Ridge. These rocks are composed mainly of shale and sandstone with lesser amounts of limestone. This formation has poor water-bearing characteristics and some quality problems with reference to sulphur.

Mississippian System (310-405 million years) (Mp)

The Price Formation is a succession of shale, sandstone and conglomerate. Much of the upper part of the formation has been removed by erosion. These rocks occur in the center of the Catawba Syncline and form caps of Fort Lewis and Brushy Mountains. Very few wells are located in this formation because of its location, but it is expected that water-bearing properties would be poor.

Quaternary Unconsolidated Deposits (Present - 3 million years) (Q+)

Unconsolidated deposits of Quaternary Age overlie the bedrock geology in Roanoke County. There are three main types in Roanoke County: Colluvium, high-level Terrace Deposits, and present-day Alluvium. The Colluvium is primarily composed of blocks of Chilhowie quartzite and/or Silurian-Devonian-Mississippian sandstone in a matrix of sand and clay. It occurs on the steep slopes below these formations and in some cases is probably still creeping down slope. The alluvium Terrace Deposits are found at the relatively higher elevations along the Roanoke River and represent flood plain and channel deposits from previous valley floors. Present-day Alluvium (sand, silt, gravel) is presently being deposited along the Roanoke River and some of its larger tributaries. The Alluvium Deposits have excellent water-bearing characteristics. Poor water-bearing properties result in the Colluvium and Terrace Deposits.

Aquifer Systems

Since many of the geologic formations have similar hydrologic characteristics, the formations described above are grouped into aquifer systems. Some aquifers in the systems are very local in nature while others extend over large areas. Three aquifer systems were defined in Roanoke County by Waller (1976; Table 2). These same systems are adopted in this report and their areal distribution is shown in Plate 9, while Plate 7 shows the occurrence of their geological components.

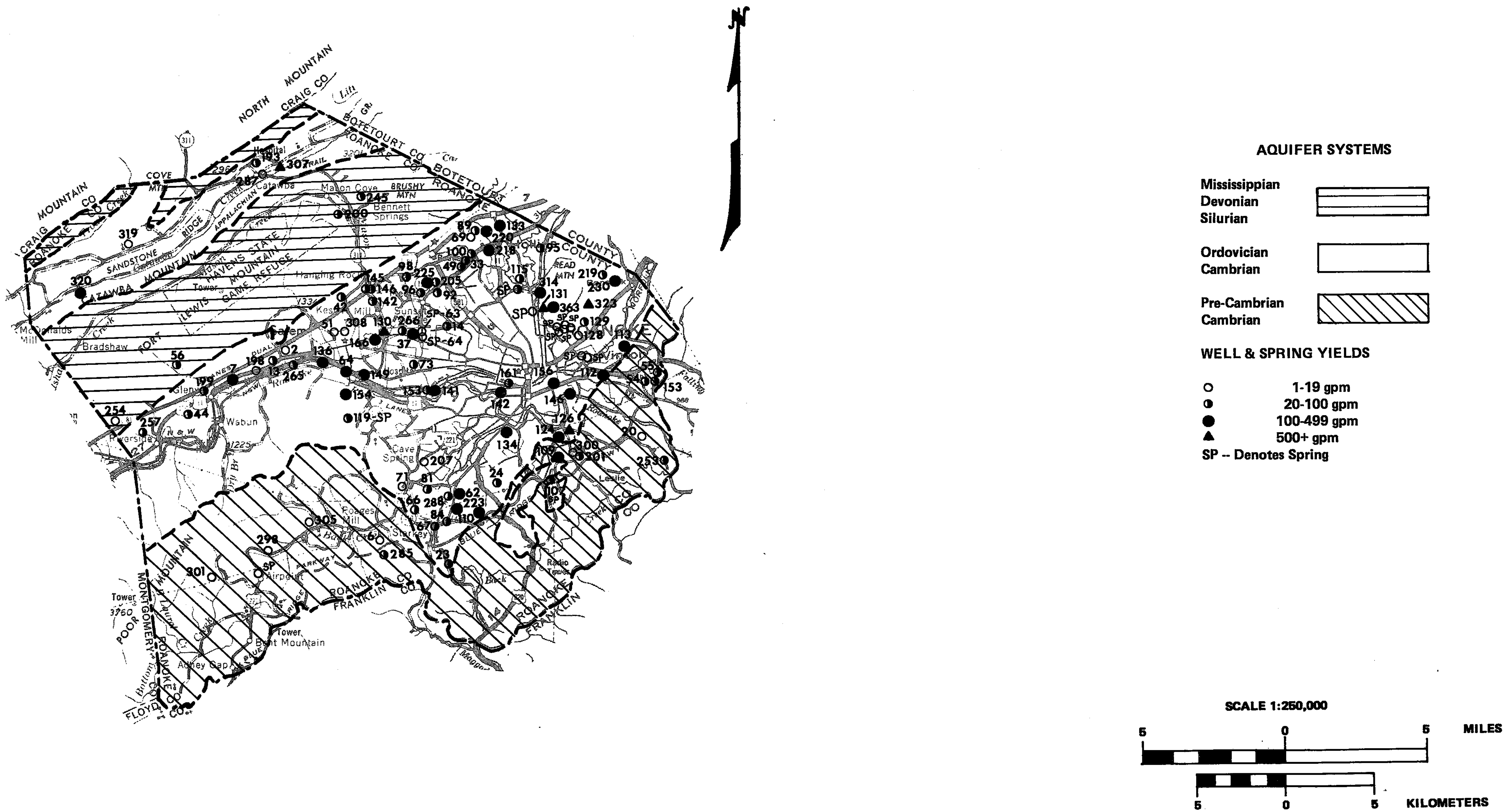
The Pre-Cambrian-Cambrian Aquifer System (PGG-AS) This aquifer system is composed of metamorphic and clastic rocks from the Blue Ridge Complex and Chilhowie Group; it occurs along the southern and extreme eastern parts of the County. Water is stored and transmitted in joints, fractures, fault zones, and contacts between different rock types; the quantities of water in the aquifer system varies widely. The larger quantities of water are found in areas where the rocks are intensely deformed and fractured, and which lie in the lower topographic areas.

Recharge to this aquifer system is local in nature and is accomplished by water percolating slowly through the soil into the openings in the rock, with more recharge taking place in the lower topographic areas. A surface stream crossing a highly jointed or fractured rock strata may lose water to the groundwater regime. The major recharge areas are outlined on Plate 10 and interpretation of this plate suggests that the western edge of the Pre-Cambrian-Cambrian Aquifer System (PGG-AS) is the only major area of recharge for that system. This large recharge

# AQUIFER SYSTEMS

## and SELECTED WELL AND SPRING YIELDS

## in ROANOKE COUNTY




Source: Virginia State Water Control Board — WCRO



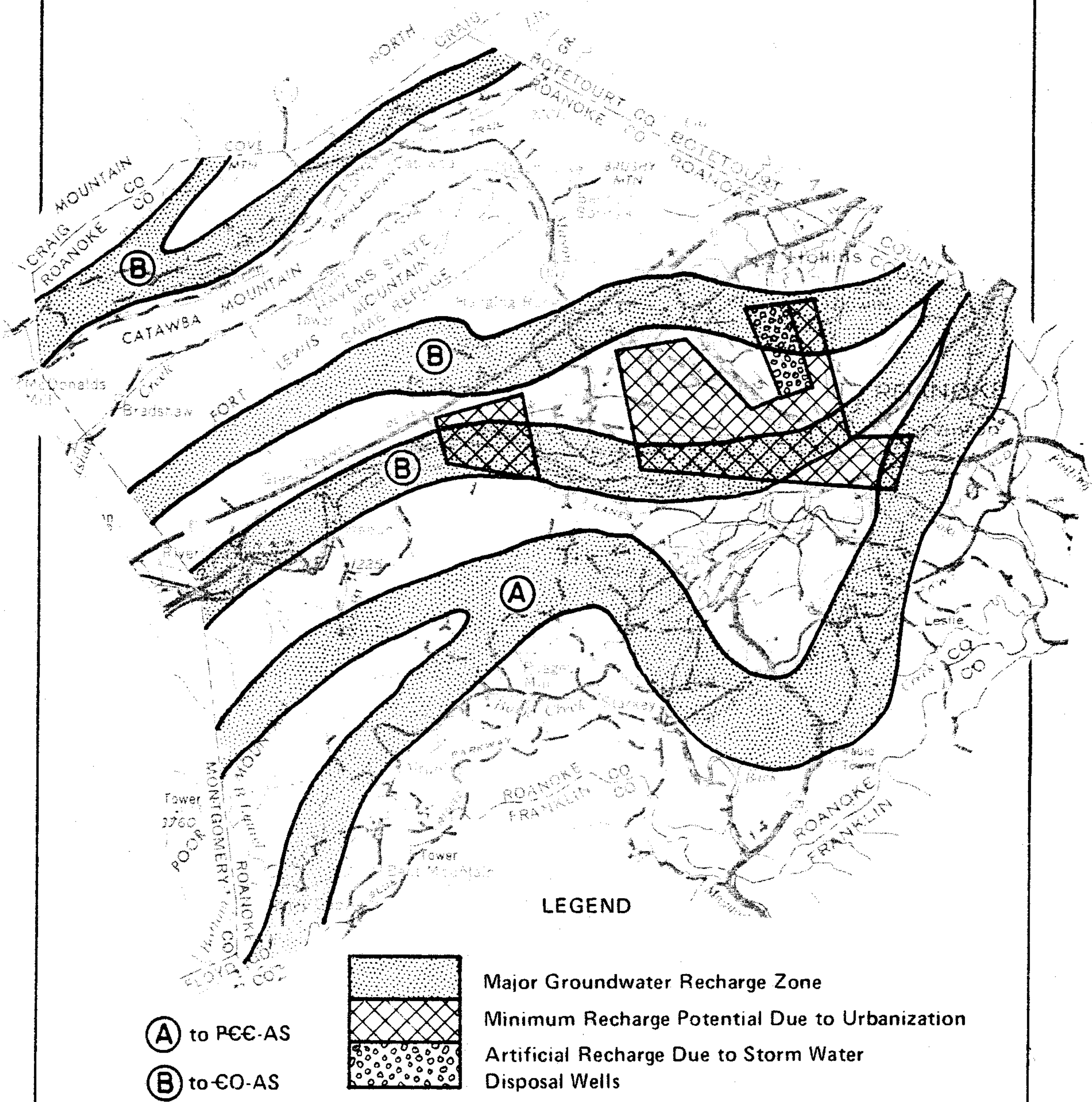
PLATE NO. 9

area conforms to the Blue Ridge Fault Zone (Plate 4).

The Cambrian-Ordovician Aquifer System (ЄO-AS) This aquifer system is primarily composed of limestone and dolomite and contains the rocks of the Shady Dolomite, Rome and Elbrook Formations, and of the Knox group, and Middle Ordovician limestones. It forms the major valley areas of Roanoke County.

Recharge to the Cambrian-Ordovician aquifer system is dependent on topography, soil characteristics, and permeability of the aquifer and the degree of development of vertical fractures in the rock (especially those near the surface). Major recharge zones are shown on Plate 10. Burdon and Papakis (1963) classified infiltration in karst areas (a terrain generally underlain by limestone, in which topography is chiefly formed by the dissolution of rock and is commonly characterized by sinkholes and caves, as is the ЄO-AS in Roanoke County) as diffuse (directly into the ground with little overland flow) or concentrated (capture or diversion of surface streams). The Cambrian-Ordovician Aquifer System is a karst aquifer and receives both types of recharge; however, the majority of recharge in this system is accomplished by diffuse infiltration and is largely dependent on the topography. As the karst land surface becomes more developed (along with the increasing development of the permeability of the aquifer) surface runoff becomes less and less important and diffuse infiltration becomes increasingly significant. The sinkholes serve to funnel precipitation into the ground. There are very few surface streams of any size that are captured and diverted underground in Roanoke County. However, most of the streams which originate on the higher ridges do lose some flow to the groundwater as they meander their way across this system, serving as a source of groundwater recharge.

# MAJOR GROUNDWATER RECHARGE ZONES
# IN
# ROANOKE COUNTY




Source: Virginia State Water Control Board – WCRO

PLATE NO. 10

The movement and storage of groundwater in this aquifer system is highly variable. Groundwater is transmitted and stored in enlarged solution channels and can be thought of as a series of interconnected conduits. The greatest concentration of pipes or openings can usually be accurately predicted by study of the structural geology of the area, and large volumes of water can be stored and transmitted in these highly solutionized zones. The nature of the aquifer system is such that it is hard, with present data, to put a definite figure on the storage capacity; however, large volumes of groundwater have been developed and it is assumed that larger quantities could be obtained if the area is studied in detail.

The Mississippian-Devonian-Silurian Aquifer System (MDS-AS) This System consists of shale and sandstone. It occurs as a northeast-trending body of rock in western Roanoke County and is also present as smaller rock bodies northeast of Roanoke City.

Recharge to this system is accomplished as water percolates through the soil cover and enters openings in the underlying rock. The openings are in the form of small joints, fractures, bedding planes, and fault zones. Recharge is local in nature, that is, the water withdrawn or discharged by a spring probably entered the groundwater regime within a two square mile area.

Most of this system is composed of shale and siltstone. Shale is highly porous, that is, it can store large quantities of water; however, the permeability (the ability of the water to move or be transmitted) is very low, unless the shale is highly fractured and consequently, extraction of the water is difficult. In fact, some of this shale in

Roanoke County forms a barrier to the movement of water. However, when groundwater inventory is taken for a particular area, this system should not be written off, because the shale feeds a certain amount of water to underlying rocks (sandstone, limestone) and adjacent aquifer systems.

The Quaternary The Quaternary unconsolidated deposits which form the flood plains and much of the lower slopes of the mountains in this area, were not included as an aquifer system because these deposits are generally too thin and limited in extent to be a major water-bearing unit, usually less than 50 feet thick. However, they are an excellent aquifer in the flood plains but a mediocre one in terraces and mountain slopes. On the other hand, the presence of these deposits on top of an aquifer system contributes significantly to the groundwater potentiality of the underlying system by temporarily storing large quantities of water, thus allowing a continuous slow recharge to this system.

# CHAPTER IV

# GROUNDWATER QUALITY

## Introduction

Both groundwater and surface water have a variety of dissolved chemical constituents present which affect their overall quality and usefulness. Normally, surface water has a greater variety and higher concentration of dissolved constituents because many factors can affect its quality, while groundwater quality is usually dependent upon the soil and rock in which the water occurs. Man's activities have a significant and immediate impact upon surface water quality but, in most cases, the impact on groundwater quality is not as immediate, although the effect may be much more severe in the long run.

## General Groundwater Quality

As mentioned above, the natural dissolved chemical constituents in groundwater are primarily derived from the soil and rock in which the water occurs and, subsequently, these constituents and their concentrations will vary from one area to another dependent upon the geology of these areas. Generally speaking, groundwater is colorless, clean and has a constant temperature equivalent to the average yearly temperature of the area where it occurs (in Roanoke County, about 56°F.)

Numerous properties can be determined by detailed water analysis techniques, however, eight parameters are usually sufficient for the overall assessment of the groundwater quality in any county. Results of these analyses are usually expressed in the metric weight system as either parts per million (ppm) or milligrams per liter (mg/l). Although not precisely equivalent, these terms are used interchangeably in describing water quality analyses. A water quality analysis that exhibits an iron (Fe) concentration of 1 ppm, indicates that the water has one unit weight of iron for every million unit weights of water; thus this water would contain one pound of iron for every million pounds of water. This same relationship holds true if the analysis is expressed in milligrams per liter (mg/l) since one million milligrams are in a liter.

The Virginia State Department of Health (Waterworks Regulations, 1974), has delineated public drinking water standards. The list is comprehensive and requires testing for chemical, bacteriological, and radiological constituents before a source can be approved as a public drinking water supply. However, the parameters discussed below ( public drinking water standards are listed in parenthesis when applicable) provide an adequate picture of groundwater quality for domestic, industrial and commercial purposes. Although not discussed below, public drinking water standards also delineate concentrations for such heavy metals as arsenic (0.1 mg/l), barium (1 mg/l), cadmium (0.01 mg/l), chromium (0.05 mg/l), copper (1 mg/l), cyanide (0.2 mg/l) lead (0.05 mg/l), mercury (0.002 mg/l), silver (0.05 mg/l) and zinc (5 mg/l). With the exception of copper and zinc, the limits listed above are based on the toxicity of the various metals and provide a reasonable safety factor for human consumption. Groundwater quality in Roanoke County is well within the above mentioned limits except as noted in Chapter V, Groundwater Problems.

Hardness. Water hardness is primarily derived from dissolved calcium and magnesium (although other dissolved constituents contribute to the total hardness value) and is most commonly evidenced by the amount of soap required to produce suds which will not form until the dissolved minerals are removed from the water. The insoluble scum, recognized as the familiar bathtub ring, that is produced is the result of the combining of the soap and dissolved minerals. In addition, when "hard" water undergoes drastic temperature changes, the calcium and magnesium will precipitate in the form of a white scale and may cause problems in hot water heaters and lines, household appliances (e.g. coffee percolators), industrial boilers and other devices that appreciably raise water temperature.

Calcium and magnesium (or carbonate) hardness is generally the major portion of total water hardness and may be reduced by boiling or through household water softeners. Other dissolved elements also contribute to water hardness and cannot be reduced by boiling, although they usually do not present a significant problem. Household water softeners can be adapted to treat this portion of the total water hardness.

The degree of water hardness is relative between different areas where water is consumed. Generally speaking, water with hardness values less than 50 ppm is considered soft, while values up to 150 ppm are not uncommon in carbonate aquifer systems and are usually not objectionable for most purposes (Johnson, 1972). Hardness values above 150 ppm become increasingly noticeable and some sort of softening process is commonly utilized for domestic and industrial purposes. Hardness values of 100 to 150 ppm can cause considerable boiler scale and when utilized, municipal water supplies are generally softened to reduce these values to about 85 ppm (Johnson, 1972).

Hydrogen Ion Concentration (pH). Measurement of the pH of the water gives an indication of whether the water will act as a weak acid or as an alkaline solution. Water with a pH value below the neutral value of seven is considered acidic, while pH values above seven indicate that the water is slightly alkaline. Acidic water will tend to corrode metals that come in contact with it (e.g., well casing, pumps, water line, etc.).

In areas with acid mine drainage, improper disposal of chemical wastes and other activities that may pose a threat to groundwater quality, determination of pH values may indicate contamination of groundwater.

Total Dissolved Solids (500 mg/l). A general indication of the water's overall suitability for many uses is given by the concentration of total dissolved solids present. Water with concentrations less than 500 ppm total dissolved solids is generally satisfactory for domestic use and for many industrial applications. Water with concentrations in excess of 1,000 ppm total dissolved solids is frequently unsuitable for many purposes, having a disagreeable taste and potential corrosiveness to well screens, casing and pumping apparatus (Johnson, 1972)

Iron (0.3 mg/l). Iron is contained in practically all water supplies and when present in even small quantities, may present considerable problems when used for domestic or industrial purposes. The limit mentioned above is based primarily on the suitability of the water for domestic and industrial purposes. Excessive amounts of iron can cause problems with staining on plumbing fixtures and during laundering, incrustations of well apparatus and the plugging of pipes. The presence of iron in well water favors the growth of iron bacteria which precipitates iron in a sheath that surrounds their bodies and can cause extreme problems in clogging of the pores in water bearing formations, pump screens, and plumbing fixtures. Several milligrams per liter of iron tend to impart an unpleasant taste in water.

The problem with high iron concentrations is closely related to its complex chemistry when dissolved in water. Iron dissolved in water will tend to precipitate as iron oxide (rust) when it comes in contact with air. In many cases, water with high iron concentrations will be clean when pumped, but after the water comes in contact with air, the water may become a little cloudy as the iron begins to precipitate out of solution. After the iron has precipitated, a small amount of rust colored material may be noticeable in the bottom of a container or, if conditions permit, a slight film will develop on the water. In cases where iron concentrations are low, preventing aeration of the water should minimize the formation of the iron precipitate. When high concentrations of iron are present, treatment for removal of this iron may be the only solution, although it is generally difficult and costly.

Manganese (0.05 mg/l). Manganese is very similar to iron in regards to its behavior and occurrence in groundwater, although manganese staining is more annoying and harder to remove. Manganese-bearing water also favors the growth of a slime-forming bacteria and may cause similar problems with clogging of pumping apparatus while at a much lower concentration than iron. As is the case with iron, preventing aeration of the manganese-bearing water will minimize the precipitation of an insoluable manganese residue.

Chloride (250 mg/l). Chloride is the primary constituent of a variety of salts; for example, common table salt is sodium chloride (NaCl). Higher concentrations than drinking water standards will give the water a salty taste and the corrosiveness will markedly increase. Water with chloride concentrations of 500 mg/l or higher will usually have a disagreeable taste; however, studies indicate that livestock such as cattle may be able to consume water with 3,000 or 4,000 ppm of chloride with no ill affect (Johnson, 1972). High concentrations of chloride in groundwater usually indicates contamination of the aquifer by sea water (in coastal areas), salt brines (common in many gas and oil producing areas) or from some of man's surface activities such as highway deicing or salt storage areas.

Sulfate (250 mg/l). The occurrence of sulfate in groundwater is principally derived from gypsum (calcium sulfate) or from the oxidation of pyrite (iron sulfide). The public drinking water standard is based, primarily, on aesthetic consideration. Concentrations as high as 750 mg/l can be tolerated; however, if manganesium sulfate (Epson Salt) or sodium sulfate (Glauber's salt) are present in sufficient amounts, infrequent users may notice a laxative effect (Johnson, 1972) and the water will have a bitter taste.

Nitrate (10 mg/l as Nitrogen or 45 mg/l as $NO_3$). The concentration of nitrate in groundwater may vary significantly from one area to another, and its presence appears to be unrelated to geology. Nitrate content in soil can be attributed to many sources such as type of vegetative cover (alfalfa and soy bean plants add nitrogen to the soil), use of fertilizers, land disposal of sewage treatment plant effluent and sludges, animal wastes and septic tank fields, to mention a few. As water percolates throught the soil, it will remove the organic nitrogen present in these wastes and transmit it into the groundwater regime. High concentrations of nitrate in well water is an indicator that the water should be tested for the presence of harmful bacteria that could also have been transported into the aquifer system from these sources.

Water analyses usually indicates concentrations of the nitrate ion ($NO_3$) as elemental nitrogen. The public drinking water standard for nitrate is established due to the possible toxicity to infants from higher concentrations. This toxic effect, known as cyanosis, causes the baby to become listless and drowsy, with his skin taking on a blue color, and may result if water containing excessive nitrate is used in preparation of the baby's formula. However, excessive nitrate in drinking water does not cause cyanosis in adults or older children, while moderate concentrations of nitrate do give a pleasant taste to water.

## Groundwater Quality in Roanoke County

An overall picture of general water quality for the three aquifer systems described in this report is presented in Table 3. This table indicates maximum, minimum, and average concentrations of the various parameters listed, according to aquifer system.

As previously mentioned, groundwater quality in Roanoke County varies somewhat from one aquifer system to another and specific problems can occur in each of the systems. However, groundwater quality throughout the County is generally very good, but high hardness values are not uncommon.

Appendix A is a detailed quality data printout for specific wells in Roanoke County for which reliable information is available. As can be seen from Appendix A groundwater quality varies somewhat from well to well, however, the general water quality for each system is about the same and because of this, a brief discussion of water quality in each aquifer system is presented below:

Pre-Cambrian-Cambrian Aquifer System. In Roanoke County, water from this system is of good quality; however, isolated instances of unacceptable iron concentrations have been recorded. The maximum and minimum concentrations of iron recorded from wells in this aquifer system are shown in Table 3. It should be emphasized that most wells will have iron concentrations within acceptable limits and that only in unusual cases will excessive iron be encountered.

TABLE NO. 3

GROUNDWATER QUALITY BACKGROUND

IN

ROANOKE COUNTY

| MISSISSIPPIAN-DEVONIAN-SILURIAN (Map Symbol: MDS-AS) | | | | ORDOVICIAN-CAMBRIAN (Map Symbol: O€-AS) | | | | PRE-CAMBRIAN-CAMBRIAN (Map Symbol: P€€-AS) | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Parameter[1] | Min. | Max. | Ave. | Parameter | Min. | Max. | Ave. | Parameter | Min. | Max. | Ave. |
| pH | 5.7 | 7.1 | 6.7 | pH | 6.6 | 8.6 | 7.5 | pH | 5.1 | 8.1 | 7.0 |
| T.D.S.[2] | * | * | * | T.D.S. | 60 | 293 | 166 | T.D.S. | 85 | 155 | 117 |
| Hardness | 6 | 154 | 67 | Hardness | 10 | 375 | 182 | Hardness | 4 | 124 | 68 |
| Iron | 0.09 | 0.3 | 0.27 | Iron | 0.01 | 1.4 | 0.16 | Iron | 0.02 | 0.5 | 0.12 |
| Manganese | 0.01 | 0.15 | 0.07 | Manganese | 0.01 | 0.4 | 0.04 | Manganese | 0.01 | 0.04 | 0.02 |
| Chloride | 1.0 | 5.0 | 2.6 | Chloride | 0.5 | 20 | 6.3 | Chloride | 1.0 | 10.0 | 4.6 |
| Sulfate | 1.2 | 19.1 | 8.6 | Sulfate | 0.7 | 49.6 | 13.8 | Sulfate | 0.04 | 5.8 | 2.8 |
| Nitrate | 0.9 | 10.2 | 6.9 | Nitrate | 0.4 | 22.6 | 5.6 | Nitrate | 0.09 | 19.9 | 8.85 |

1. Except for pH values of parameters listed are expressed in milligrams per liter (mg/l)

2. Total Dissolved Solids (asterisk indicates insufficient data)

Source: State Water Control Board--WCRO

Cambrian-Ordovician Aquifer System. The majority of rock types in this system is limestone and dolomite which can result in very high hardness values due to the dissolution of calcium and magnesium by the groundwater. Hardness values in excess of 200 mg/l are not uncommon, although the range is generally 100 mg/l to 175 mg/l. Excessive amounts of sulfate present in the water are derived from certain geologic formations in the aquifer system. Notably, the Edinburg Formation (Plate 7) contains water that is normally higher in sulfate concentrations than other members of this system. Iron-bearing water may be encountered in areas where faults and fractures, privileged places of mineralization, are widespread.

Mississippian-Devonian-Silurian Aquifer System. This system, due to its geologic history, may have water which presents problems with excessive iron, manganese and sulfate concentrations. Although it is difficult to predict if a certain well location will encounter water with these problems it can generally be stated that water from this system has higher concentrations of iron, manganese and sulfate than the other aquifer systems. While uncommon, occasional pockets of trapped methane gas have been encountered while drilling in this system. The gas is a result of decomposition of organic matter contained in the shale of member formations in the system, and through folding of the bedrock, pockets of gas may be trapped in small cavities and anticlinal structures.

Alluvium, Colluvium and Terrace Deposits. From the standpoint of quality, water from these unconsolidated deposits is different from that in the three previously described aquifer systems. Water in these deposits is parent to surface water as a consequence of their being hydrologically connected with streams and rivers. Since these deposits are on the surface of the land with minimal soil cover ( if any), the water they contain is subject to quality problems akin to the waters of surface streams and rivers. However, the deposits constitute a filter, which should generally result in an improvement in the quality of their water with respect to that of the streams and rivers. Generally, their water is of good quality, without hardness, iron or other problems.

Man's Influence on Groundwater Quality

Surface water exists in a fairly "open" system, that is, factors influencing water quality usually result in immediate detection although the effects may vary in their degree of severity and are usually short-lived in a particular area because the movement and dissipation of pollutants takes place quickly. Groundwater, however, exists in what can be termed a "closed" system, that is input to the system is limited by percolation through overlying materials. Movement in any groundwater area is relatively slow when compared to surface water velocities. Therefore, when contaminants reach groundwater, the contamination is likely to be in that particular area for quite awhile, and become evident after a long interval.

Detection of contaminated groundwater is not as immediately apparent as for surface water. Man's surface activities can proceed for years with no noticeable effects on groundwater quality and suddenly appear as a relatively severe pollution problem. For example, an automotive garage may dispose of its waste oil by dumping it out back of the facility for years, with no groundwater quality problems evident. However, it may take years for the oil to slowly percolate down through the overlying soil cover and through the bedrock, to appear, quite suddenly, in a neighbor's well. When something like this occurs, it is very difficult, if not impossible, to correct the situation.

Man's activities may result in a much swifter impairment of groundwater quality than the above example and practically all of them have the potential for adversely affecting groundwater quality. In carbonate areas, sinkholes provide and solution cavities permit easy access and rapid transmission of contaminants in the groundwater regime. Poorly constructed water wells are another means for rapid contamination of groundwater by permitting surface water to flow down the well casing and into the groundwater regime.

Subsurface disposal of storm water run-off, such as used in the Williamson Road area of Roanoke City, may cause groundwater contamination problems due to the pollutants that are picked up by the water prior to its disposal.

The capacity of soils for filtering and treating waste products generated by man is generally good; however, if careful consideration is not given to the planning, design and construction of land disposal areas, ground water contamination may result. Sanitary landfills, chemical waste disposal areas, sludge disposal areas, and land application of sewage treatment plant effluents, to mention a few, all require adequate planning, design and operation to assure that groundwater quality in the area is maintained. Many cases throughout the country have been documented where groundwater contamination has been detected 25 to 50 years after a land disposal site has been abandoned. Experience has shown that with present technology, rehabilitation of contaminated aquifers is physically difficult and monetarily expensive.

In addition to land disposal of wastes, other surface activities can seriously effect groundwater quality in a particular area. The improper or excessive use of fertilizers, pesticides, herbicides and larvaecides, deicing salts or accidental spilling of petroleum products have a severe and long lasting potential for groundwater contamination. It must be recognized that prevention of groundwater contamination is the key to maintaining groundwater quality and that rehabilitation of contaminated ground water resources is very difficult, if not impossible, to attain.

In Roanoke County, a few isolated areas have been identified as having specific groundwater quality problems associated with man's activities. These areas are discussed in Chapter V , Groundwater Problems. Although not much can be done to remedy the present situations, it should be recognized that these problem areas have resulted in man's indifferent attitude towards his environment and the natural resources at his disposal. Groundwater most definitely should be considered as a valuable natural resource to be protected and conserved so that the best usage of it remains possible. Hopefully, these contaminated groundwater areas will serve as lessons to what damage can be done to this delicate natural resource if adequate protection, development and management measures are not implemented.

# CHAPTER V

# GROUNDWATER PROBLEMS

## Introduction

With few exceptions, groundwater in Roanoke County can provide a relatively abundant and trouble-free source of high quality water for most purposes. The previous chapter provides a generalized discussion of groundwater quality variance in Roanoke County. Although general groundwater quality differences exist between the three previously discussed aquifer systems, isolated problems with groundwater have been defined in the County. Though not extensive in their distribution, some of these problems discussed below can have severe consequences in specific areas of the County. Solutions to specific groundwater problems can be devised; however, it must be remembered that , in most cases, these solutions are difficult and expensive to implement, especially those relative to groundwater contamination, and that prevention is the best remedy.

## Water Levels

A water well in an aquifer is analogous to a straw in a glass of water, except that the glass of water does not receive any recharge, and the aquifer does. As water is removed through the straw, the water level in the glass declines, until the glass is empty. However, if the glass were supplied with a flow of water equal to the rate of withdrawal from the straw, the water level in the glass would remain the same. A similar situation is present in an aquifer system with a well withdrawing water from it. If the withdrawal rate is equal to or less than the recharge to the aquifer, the water level in the aquifer will remain the same, although a cone of depression may be developed in the immediate area of the well because the permeability of the rock will not permit an instantaneous flow of water to the well.

When wells or well fields are pumped in excess of the recharge rate to an aquifer system, the water level in that system will decline, tending toward depletion of the groundwater supply. In areas where groundwater supplies an excessive portion of the total water use, a gradual lowering of water levels may result involving high costs of pumping,land surface subsidence and other negative effects. This is not the case in Roanoke County because groundwater supplies only about 33 percent of the total water demand; however, localized water level decline may be present in specific areas of the County where groundwater usage is quite high. As future water demand is supplied by groundwater, proper development and management of wells and well fields must be employed to prevent de-watering of aquifer systems and to insure conservation of groundwater and its usage under optimal conditions.

Pollution

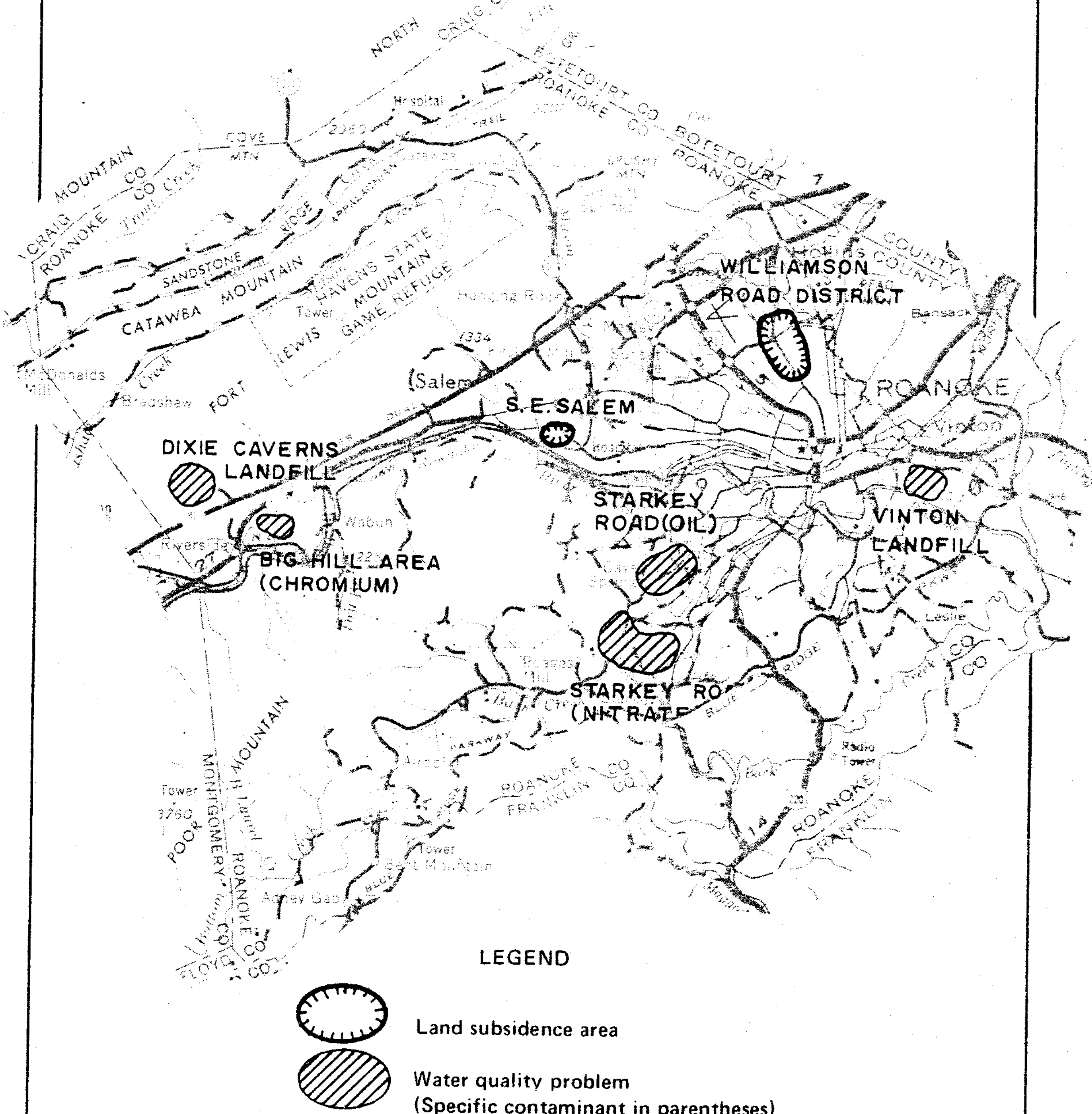
Inadequate well construction is perhaps the most common factor in groundwater contamination. Usually, the contamination is localized and is the result of polluted surface water flowing down the sides of the well casing and entering the groundwater. Pollution of groundwater by bacteria can be attributed to poor well construction in some cases and, although easy to treat by chlorination, some expense and inconvenience is experienced by the user. If wells are properly constructed (i.e., use of sufficient grouting and adequate well casing), contamination of the groundwater supply by polluted surface water entering along the well casing will be minimized. Subsurface disposal by septic tank fields and pit privies is the most common waste treatment method employed in rural areas, and care must be taken to assure that adequate soil depth and characteristics are present to sufficiently treat these wastes and thus avoid groundwater contamination, and that wells are far from septic tanks, privies and other waste disposal facilities.

Many of man's surface activities have the potential for severe and long-term groundwater contamination. Septic tanks, sanitary landfills, open chemical storage centers, highway deicing activities, sludge disposal areas, industrial waste disposal areas, and most any other activity where toxicants are placed on the land surface have the potential for groundwater contamination. In most cases, contamination of the groundwater is not immediate, but rather has a long incubation period before detection and, once discovered, may continue for long periods of time. Only by implementation of preventive measures, including proper construction techniques and operational controls, can groundwater quality be assured.

In Roanoke County, a few isolated cases of contaminated groundwater have been documented and are presented below (Plate 11). In addition, the problem of subsidence due to excessive ground water withdrawal and one of subsidence due to localized groundwater recharge are mentioned.

Starkey Road Area, South Roanoke. Several cases of groundwater contamination due to hydrocarbons have been documented in this area. In any area where gasoline and oil storage and distribution facilities are present, contamination of the groundwater by these substances is possible. Either by spills or sloppy filling operations, these hydrocarbons will soak into the ground and find their way to the groundwater regime. When this situation results, removal of oil-soaked soil may cut off the source of further contamination but rehabilitation of the polluted aquifer

# GROUNDWATER PROBLEM AREAS
# IN
# ROANOKE COUNTY




Source: Virginia State Water Control Board – WCRO

PLATE NO. 11

is extremely difficult. Again, proper planning, construction, operation and spill contingency procedures need to be developed for these facilities to prevent groundwater contamination.

Big Hill Area, Southwest Roanoke County. Chromium contamination in this area has been documented in four wells and concentrations up to 7.9 ppm have been recorded which is about 160 times the public drinking water level of 0.05 ppm. Spillage of chromium plating solution on the land surface has resulted in this toxic material reaching the groundwater regime via a sinkhole. Although elimination of the discharge will prevent further contamination, rehabilitation of the affected aquifer will be very difficult to attain.

Williamson Road Area, Northeast City of Roanoke. The City of Roanoke currently uses approximately 120 wells for the disposal of storm water runoff. Although the actual effect of the runoff water on the groundwater quality has not been determined, localized subsidence does present a problem. The artifical recharge of the groundwater in that area has resulted in a "washing out" effect of the subsurface soils and, consequently, subsidence has occurred causing structural damage to buildings and roadways and in one case, being responsible for breakage of a sanitary sewer line which introduced raw sewage into the subsurface environment. This introduction of storm water runoff and associated contaminants could have severe effects on the qulaity of groundwater in the area.

City of Salem. Reports have been received of localized subsidence in the southeastern sections of Salem, probably resulting from high industrial withdrawal rates. Groundwater users which require large volumes of water, especially if obtained from one or two high capacity wells, may cause extensive cones of depression, aquifer dewatering and localized subsidence. Solutions to this particular kind of problem are relatively simple and would include the substitution of several low-capacity well fields, rather than one or two high-capacity wells to meet the user's needs. If withdrawal were terminated, water levels should climb back to their previous levels, however, the areas of subsidence would remain at their current elevation and would not return to their pre-subsidence elevation.

South Roanoke County, Starkey Area. A few instances of high nitrate concentrations have been recorded from wells in this area. One or two recorded cases have nitrate levels above the drinking water limits previously discussed, although several wells have been tested with nitrate levels above the averages for the Pre-Cambrian-Cambrian and Cambrian-Ordovician Aquifer Systems.

Sanitary Landfills. Several sanitary landfills are operated in Roanoke County and observation wells located at these sites indicate some localized groundwater contamination at two operations (Plate 11). Sanitary landfills provide a needed and useful service to the community and it is through adequate planning and operation that groundwater contamination will be prevented. Prior to strict Federal and State regulations, disposal of solid waste was undertaken primarily as an open dump, with little or no precautions to minimize environmental impact. Since promulgation of sanitary landfill regulations, emphasis has been placed on all phases of the landfill operation to minimize the impact of such operations on the environment in regard to both surface and groundwater resources.

In conclusion, one invariably comes back to the fact that prevention of groundwater contamination is the key to maintaining groundwater quality. Only by preventing contaminants from reaching the groundwater regime can the high quality of groundwater in Roanoke County be maintained. The current state of technology, as advanced as it is in some areas, is insufficient to realistically and economically address the problem of aquifer rehabilitation once contamination has taken place. Although some groundwater contamination problems are easier to address than others, the basic fact remains that once this valuable resource has been defiled, it is difficult and expensive to restore it to its uncontaminated state.

# CHAPTER VI

# GROUNDWATER POTENTIAL AND DEVELOPMENT

## Introduction

Until recently, groundwater has been considered as a temporary, or at best, a secondary source of water for meeting the needs of Roanoke County. However, with the extremely high development cost for surface water supplies and the treatment thereof, groundwater has received national attention as a source for meeting an increasing percentage of the country's future water needs. Two positive reasons come to mind: (1) development and treatment costs are approximately five to ten times and three to five times, respectively, less for groundwater than for surface water; and, (2) greater than 90 percent of the potable water is underground. With these and other factors in mind, it would seem appropriate for water users in Roanoke County to consider the County's groundwater potential with the following points in mind: (1) What potential does groundwater have in meeting the water needs of the County?; (2) Is the groundwater a reliable source of water for the County's future needs?; and, (3) Is the present trend of abandoning existing wells and replacing them with surface water supplies the right direction for the County to move in meeting its water needs? These factors and others should be considered when evaluating a given area for a water supply.

## Groundwater Potential

When evaluating the groundwater potential or availability of a given area, a number of factors which control how much groundwater can be safely withdrawn from a particular aquifer should be studied. In Chapter III, three major aquifer systems were identified in the County (Plate 9).

The Pre-Cambrian-Cambrian aquifer system (PCC-AS) , located in the eastern and southeastern portions of the County, has a wide variety of production capabilities ranging from 1 gpm to 150 gpm (Table 4). Of the wells which had data available, the average yield from the PCC-AS is approximately 38 gpm. However, this data is somewhat biased from the true picture. Approximately 25 percent of the wells for which data was available, were domestic wells. In the case of domestic wells, when enough water has been found to supply the particular home involved (generally 1.5 to 6 gpm) the drilling is terminated. Therefore, the true production capabilities are not determined. Another factor which has to enter into the analysis of this data is that most wells are located where they are for convenience sake and not with respect to obtaining a certain yield, while wells drilled along fracture traces and fault zones will have much larger yields than wells in other parts of the system.

TABLE 4

WELL YIELDS FOR AQUIFER SYSTEMS
IN ROANOKE COUNTY

| Aquifer Systems | Number of Wells | Range of Yield (gpm) | Average Yield (gpm) | Estimated Pumpage (MGD) |
|---|---|---|---|---|
| PCC-AS * | 30 | 1 to 150 | 38 | 1.34 |
| CO-AS Δ | 172 | 1 to 1,160 | 105 | 8.75 |
| MDS-AS † | 6 | 8 to 50 | 22 | .15 |
| TOTAL | | | | 10.24 |

* Precambrian-Cambrian-Aquifer System
Δ Cambrian-Ordovician-Aquifer System
† Mississippian-Devonian-Silurian-Aquifer System

Source: Virginia State Water Control Board-WCRO

The Cambrian-Ordovician Aquifer System (GO-AS, Plate 9), comprises the Roanoke Valley and Catawba Valley portions of the County. Approximately 70 percent of the groundwater used in the County is taken from this system. Wells drilled in this system are producing from 1 to 1,160 gpm (Table 4) and range of production is primarily due to the variety of water needs. For example, industrial users who require large quantities of water have located wells in the high production zones of the system. Data taken from 172 wells located in the GO-AS shows an average yield of 105 gpm. Plate 9 shows that the high yield wells are located along well-defined fractures or along major fault zones. These zones of broken rock can be located by using various techniques which are discussed later in this chapter.

The Mississippian-Devonian-Silurian Aquifer System (MDS-AS) underlies most of the western portion of the County (Plate 9), which is sparsely populated, and consequently, data is somewhat limited as to the groundwater availability (Table 4). The average yield from this system is 22 gpm with the highest recorded yield of 50 gpm. With most of the data coming from domestic supplies, this information is somewhat skewed to the low side and does not accurately represent a true picture of groundwater potential in this system. Wells located with reference to obtaining large quantities of water, such as industry would require, give a more complete picture of the availability of groundwater in this area.

Groundwater Development

In the first portion of this Chapter, groundwater availability or potential with respect to each of the three aquifer systems has been discussed. However, to obtain the full potential from an aquifer, proper development with respect to exploration, conservation, protection must be done, and appropriate management of the resource achieved.

The first step in correctly developing an aquifer is to find the needed quantity and quality of water. Appendix B is a water well data summary printout for selected wells in Roanoke County. This printout can provide the reader with information on well depth, casing size, static water level, yield and water bearing zones. Locations of specific water wells are indicated by The Virginia Planar Coordinate System if the number two precedes the coordinate or by lattitude and longitude coordinates is these numbers are preceded by an asterisk(*). Both lattitude and longitude and Virginia Planar Coordinates are indicated on U.S.G.S. 7.5' Topographic Maps and further information on the use of these coordinate systems may be obtained from the Virginia Division of Mineral Resources or the State Water Control Board.

Water well site selection may be accomplished by different methods or be the result of the combination of various modes of investigation. Hydrogeologists utilize topographic and geologic maps and interpretation of aerial photographs in combination with field investigation. In many instances, the water well driller may have sufficient experience in a particular area to find a suitable well site for domestic purposes. However, users requiring high yields should obtain professional consultation or investigate the feasibility of exploratory drilling prior to committing themselves to a particular well location.

There are many different water needs ranging from single home dwellings to large industrial users. Commonly, they are broken down into three categories: Domestic, Public and Industrial.

<u>Domestic Supplies.</u> Domestic supplies or private systems are those which have less than 15 connections or less than 25 people on a single

well (Virginia Department of Health). This type of system includes most all of the rural areas of the County. For a single home dwelling, one commonly needs at least 1.5 to 2 gpm to have a reliable water supply and the State Department of Health should be contacted as for water potability. After property is acquired, the first thing a citizen should do is obtain a water supply before any construction starts. There have been many cases, primarily in the Lost Mountain area of southwest County and the western part of the County (Plate 1), where water was not found because the well location was selected for convenience sake and not in consideration of hydrogeologic factors.

Public Supplies. A public system defined by the Virginia Department of Health includes all wells which have 15 or more connections or 25 or more people on one well. In Roanoke County approximately 100 public systems are supplying approximately 7,440,000 gpd to about 41,335 citizens or about 25 percent of the Roanoke Metropolitan Area population (Table 5). Table 5 also has the percent of groundwater withdrawn for public supply systems from the various aquifer systems (Plate 9) and it is evident that the GO-AS supplies a major portion of the water. This is primarily because the most densely populated areas lie over this aquifer system. The other systems, especially the PGG-AS, have the potential of supplying much more water than is portrayed in the table. In developing public systems, the groundwater potential needs to be explored prior to laying out a subdivision, and the State Department of Health shall be contacted as for water potability. If it is apparent, after investigation has taken place, that the water system will have to be placed in the lower topographic area, enough area should be set aside to assure protection from septic tank drainage and surface runoff. Also, one should consider developing a well field which utilizes three to four wells spaced at regular intervals (usually 200 to 400 feet apart) to allow the most efficient potential to be developed. In the actual construction of the wells, the diameter of the well could be increased from the typical six inches to 12 or 16 inches. This has been done in other parts of the United States with similar geologic conditions with a great degree of success.

TABLE 5

GROUNDWATER USAGE FOR PUBLIC SUPPLY SYSTEMS
IN ROANOKE COUNTY

| Owner | Average Usage, GPD | Population Served | Percent Withdrawal From Each Aquifer System* For Public Supplies | |
|---|---|---|---|---|
| Roanoke County Public Service Authority | 3,240,000 | 18,000 | MDS-AS | 2 |
| Roanoke City, Crystal Springs | 3,200,000 | 17,777 | ϵO-AS | 80 |
| Other Public Systems | 1,000,000 | 5,555 | Pϵϵ-AS | 18 |
| TOTAL | 7,440,000 | 41,334 | | 100 |

*All symbols explanation on Table 4

Sources: 1. Roanoke County Public Service Authority
2. Comprehensive Water, Sewer and Storm Drainage Facilities Plan, Vol.1, 1971
3. Virginia State Water Control Board - WCRO

Industrial Supplies. Data taken from Virginia State Water Control Board files indicates that there are at least 15 industrial users of groundwater in Roanoke County. The largest users are withdrawing approximately 8,000,000 gpd with a total combined groundwater withdrawal of 2.8 million gallons per day (MGD). All of this production is being withdrawn from the Cambrian-Ordovican Aquifer System (ϵO-AS, Plate 9).

Most of the large users are located along major tributaries and are in very close proximity to the major fault zones of the aquifer systems, and it is no accident that the industries are located along these high production zones. It is apparent that some of the companies had detailed investigations made of the Roanoke area to locate zones of high groundwater potential prior to construction of facilities.

## Area of High Groundwater Potential

Plate 9, in addition to delineating the aquifer systems, shows areas where high yields of groundwater can be obtained. These areas are discussed in the section on industrial use and are located along major fault zones and fracture traces. Surface streams, when establishing their courses, naturally take the least zone of resistance and consequently streams generally flow along zones of weaker material which in many cases, coincide with fault zones and fracture traces.

In developing these areas of high potential, some preliminary investigation and exploratory drilling with small diameter holes should be conducted to determine the area of best potential. After areas of high potential have been delineated it should be determined whether a well field consisting of several wells should be installed to supply the water needs rather than relying on the customary practice of utilizing one or two high capacity wells to supply the required amount of water.

# CHAPTER VII

# FINDINGS, CONCLUSIONS AND RECOMMENDATIONS

## Findings

This report has provided a generalized picture of the groundwater resources of Roanoke County and discusses the factors influencing its quality, occurrence, availability, potential and development. Although this report has centered on the manifold aspects of groundwater, it should be noted that a direct relationship exists between surface water and groundwater resources, because some water that occurs on the surface will eventually become groundwater and vice versa. Surface water provides recharge to the groundwater regime, and during periods of low surface water flows, groundwater sustains surface water streams. Therefore, the intimate relationship between groundwater and surface water must be recognized and considered when evaluating the water resources of Roanoke County.

Current data on file with State agencies indicate that groundwater in Roanoke County has been utilized in small proportion to its potential, and that future water needs can be met by the abundant, high quality groundwater of the County (however, hardness and iron problems happen to occur).

Many of the geologic formations in the County have similar hydrologic characteristics, and thusly, the formations were grouped into three major aquifer systems: (1) the Pre-Cambrian-Cambrian Aquifer System (P€€-AS) is located along the southern and extreme eastern portions of the County. The water-bearing properties vary from poor to good depending on whether a well is located along faults and fractures where good yields are obtained. Water quality is excellent except for sparse areas of high iron and manganese;

(2) the Cambrian-Ordovician Aquifer System (ЄO-AS) forms the major valley areas in the County. The water-bearing properties are good to excellent. This aquifer system is the most productive in the County, and the quality of water in this system is generally excellent; and (3) the Mississippian-Devonian-Silurian Aquifer System (MDS-AS) is found in the western portion of the County. Fair to good water yields are available in the valleys, poor conditions on the higher ridges. High iron and sulphur concentrations can be found in certain areas.

Groundwater development in Roanoke County in the past few years has been on the rise. At present, approximately 10.5 million gallons per day of groundwater is being withdrawn for public and industrial uses primarily from the Cambrian-Ordovician Aquifer System. This figure does not include the private wells (domestic users). Most important in developing the present and future groundwater needs in the County is the realization that groundwater is a delicate and vulnerable resource which deserves adequate protection, conservation and management if it is to fullfil its potential as an abundant, high quality and economical water supply.

Man's activities (such as mining, waste injection, septic tank disposal of wastes, landfills, land application of wastes, storm water disposal wells, and the like) can have a severe effect on groundwater since wastes are being or have the potential of being, introduced to the subsurface with subsequent contamination of groundwater, which is especially difficult and expensive to restore. Some cases of groundwater contamination have been documented in the County, as well as problems of land subsidence.

Conclusions

The potential for additional groundwater development is excellent in Roanoke County. It is conservatively estimated that a safe yield of an additional 50 to 60 million gallons per day could be withdrawn under a properly managed program with minimal effects on the aquifer systems. Large groundwater potential areas are present in Roanoke County for future industrial and municipal growth.

## Recommendations

When planners and government officials are addressing land use in Roanoke County, consideration should be given to maintaining open areas that are delineated as groundwater recharge zones. These areas could be utilized for recreational activities similar to current practices for watersheds for surface water reservoirs.

A comprehensive water management program, addressing both groundwater and surface water, should be formulated. A method of achieving this total management program would be through the formulation of a management board comprised of representatives of the four local entities. After all, the separate governmental boundaries are not related to either surface or groundwater regimes.

Groundwater needs to be recognized as a valuable natural resource and accurate studies conducted to obtain optimum utilization of this resource. For example, with accurate investigation, large well fields located in high groundwater potential areas could be constructed to supply a significant portion of the industrial and municipal growth.

Subdivisions and multiple-unit housing developments should have community services that provide central sewerage with development of groundwater for individual or community supplies. At the present time, central water supplies are stressed with individual household sewage disposal being accomplished through septic tank fields. This leaves groundwater open to contamination by inadequately or improperly installed disposal systems. The potential for groundwater contamination could be greatly reduced or eliminated if central sewerage service were the primary service offered by the developers.

# APPENDIX A

## SUMMARY OF GROUNDWATER QUALITY ANALYSES FOR ROANOKE COUNTY

The computer printout on the following pages lists basic groundwater quality data available for many of the wells listed in the water well data summary (Appendix B). There are some quality analyses listed for wells not included in Appendix B; however, well data is available for these wells and may be obtained by contacting the State Water Control Board's West Central Regional Office in Roanoke or the Headquarters Office in Richmond.

V I R G I N I A   S T A T E   W A T E R   C O N T R O L   B O A R D

B U R E A U   O F   S U R V E I L L A N C E   A N D   F I E L D   S T U D I E S

SUMMARY OF GROUNDWATER QUALITY ANALYSES FOR ROANOKE COUNTY

********************************************************************************************

THE FOLLOWING LIST OF GROUNDWATER QUALITY DATA SUMMARIZES BASIC DATA OBTAINED FROM ANALYSES OF GROUNDWATER, COLLECTED FROM WELLS AND SPRINGS, WHICH ARE ON PERMANENT FILE IN THE OFFICES OF THE VIRGINIA STATE WATER CONTROL BOARD. ADDITIONAL GROUNDWATER QUALITY INFORMATION FOR MANY OF THESE WELLS AND SPRINGS IS AVAILABLE AND CAN BE OBTAINED BY CONTACTING THE APPROPRIATE REGIONAL OFFICE OR THE BUREAU OF SURVEILLANCE AND FIELD STUDIES AT THE AGENCY HEADQUARTERS IN RICHMOND.

************ EXPLANATION OF PARAMETERS ************

SWCB NO: STATE WATER CONTROL BOARD NUMBER - A SEQUENTIAL NUMBERING SYSTEM USED WITHIN A COUNTY; WHEN REFERRING TO A SPECIFIC WELL USE THIS NUMBER

OWNER AND/OR PLACE: IDENTIFIES ORIGINAL OR CURRENT WELL OWNER AND/OR LOCATION OF WELL.

DATE SAMP: DATE SAMPLED - MONTH AND YEAR IN WHICH WATER SAMPLE WAS COLLECTED.

PH: HYDROGEN ION CONCENTRATION - BASED ON A SCALE OF 1 THROUGH 14, WATER WITH A PH GREATER THAN 7.0 IS CONSIDERED TO BE BASIC OR ALKALINE; THE LARGER THE PH VALUE, THE MORE ALKALINE THE WATER. WATER WITH A PH LESS THAN 7.0 IS CONSIDERED TO BE ACIDIC; THE SMALLER THE PH VALUE, THE MORE ACIDIC THE WATER.

SPEC COND: SPECIFIC CONDUCTIVITY - AN INDICATOR OF THE RELATIVE AMOUNT OF DISSOLVED MINERALS IN WATER; HIGHER VALUES INDICATE GREATER AMOUNTS OF DISSOLVED MINERALS; UNIT OF MEASUREMENT IS MICROMHO

T-DIS SOLID: TOTAL DISSOLVED SOLIDS - INDICATES TOTAL AMOUNT OF DISSOLVED MINERALS IN WATER; UNIT OF MEASUREMENT IS MILLIGRAMS PER LITER

HARDNESS TOTAL: TOTAL HARDNESS - CAUSED BY THE PRESENCE OF CALCIUM, MAGNESIUM, IRON, ZINC , AND OTHER TRACE METALS. UNIT OF MEASURE IS MILLIGRAMS PER LITER.

HARDNESS CA,MG: CALCIUM-MAGNESIUM HARDNESS - INDICATES THAT PORTION OF TOTAL HARDNESS CAUSED BY CALCIUM AND MAGNESIUM, WHICH ARE GENERALLY RESPONSIBLE FOR ALMOST ALL HARDNESS IN WATER. UNIT OF MEASURE IS MILLIGRAMS PER LITER.

THE AMOUNT OF HARDNESS IN WATER WILL AFFECT THE ABILITY OF SOAP TO LATHER OR CLEANSE BECAUSE OF THE TENDENCY OF THE IONS CAUSING HARDNESS TO REACT WITH SOAP. THE HIGHER THE HARDNESS OF WATER, THE MORE DIFFICULT IT IS FOR SOAP TO LATHER.

NOTE: TOTAL HARDNESS IS GENERALLY DETERMINED BY CHEMICAL TITRATION WHEREAS CALCIUM-MAGNESIUM HARDNESS IS GENERALLY DETERMINED BY MATHEMATICAL CALCULATION FROM CHEMICALLY-DETERMINED VALUES FOR CALCIUM AND MAGNESIUM. BECAUSE OF THIS DIFFERENCE IN DETERMINATION, THE CALCIUM-MAGNESIUM HARDNESS VALUES FOR SOME ANALYSES WILL BE LARGER THAN THE TOTAL HARDNESS VALUE.

******** PARAMETERS LISTED BELOW ARE MEASURED IN MILLIGRAMS PER LITER ********

| | | |
|---|---|---|
| FE: IRON | MN: MANGANESE | CA: CALCIUM |
| MG: MAGNESIUM | NA: SODIUM | K: POTASSIUM |
| HCO3: BICARBONATE | SO4: SULFATE | CL: CHLORIDE |
| | NO3: NITRATE (AS NO3) | |

VIRGINIA STATE WATER CONTROL BOARD

BUREAU OF SURVEILLANCE AND FIELD STUDIES

SUMMARY OF GROUNDWATER QUALITY ANALYSES FOR ROANOKE COUNTY

| SWCB NO | OWNER AND/OR PLACE | DATE SAMP | PH | SPEC COND | T-DIS SOLID | HARDNESS TOTAL | HARDNESS CA,MG | FE | MN | CA | MG | NA | K | HCO3 | SO4 | CL | NO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | ANDREW LEWIS WTR WKS | 10 73 | 8.0 | 182 | 145 | 126 | 130 | 0.03 | | 30.4 | 13.3 | 1.6 | 1.6 | | 1.3 | 2.0 | 6.4 |
| 3 | FORT LEWIS TERRACE | 12 64 | 7.6 | | | | 109 | 0.02 | | 30.0 | 8.4 | 0.7 | | 115 | 2.5 | 2.6 | 1.3 |
| 4 | BROADVIEW WATER WORKS | 4 71 | 7.3 | | 415 | | 196 | 0.18 | | 9999.9 | 999.9 | 99999.9 | | | 9999.9 | 99999.9 | 442.6 |
| 15 | CRESCENT HEIGHTS #1 | 7 65 | 7.6 | | | | 133 | 0.08 | | 28.7 | 14.8 | | | 163 | 1.7 | 1.5 | 6.2 |
| 16 | CRESCENT HEIGHTS #2 | 7 65 | 7.8 | | | | 132 | 0.11 | | 27.6 | 15.2 | 2.7 | | 164 | 0.7 | 1.5 | 3.1 |
| 17 | E F CYPHERS WESTBROOK | 3 65 | 8.0 | | | | 146 | 0.01 | | 40.8 | 10.9 | 39.0 | | 149 | 9.2 | 5.2 | 1.3 |
| 18 | BELLE HAVEN #2 | 12 64 | 7.4 | | | | 181 | 0.18 | | 62.0 | 6.5 | 39.0 | | 205 | 4.4 | 1.3 | |
| 18 | BELLE HAVEN #2 | 8 64 | 7.5 | | | | 138 | 0.01 | | 37.8 | 10.6 | 34.8 | | 212 | 2.3 | | |
| 26 | NEW HOPE WATER AGENCY | 11 73 | 8.3 | | 128 | 103 | 102 | 0.24 | 0.12 | 21.6 | 11.9 | 0.5 | 1.1 | | 0.6 | 0.5 | |
| 27 | APCO SUBSTATION | 4 75 | 7.4 | | | 128 | 160 | | | 39.0 | 15.3 | 2.3 | 1.5 | | 3.2 | 9.0 | 2.2 |
| 30 | SUNSET VILLAGE #2 | 12 64 | 7.5 | | | | 153 | 0.01 | | 34.6 | 16.1 | 39.0 | | 174 | 2.1 | 2.3 | 0.4 |
| 32 | ORCHARD HEIGHTS #2 | 8 64 | 7.4 | | | | 294 | | | 73.4 | 26.9 | 39.0 | | 157 | 138.4 | 2.5 | 8.9 |
| 34 | EDGEWOOD LAKESIDE #1 | 10 73 | 8.1 | 245 | 135 | 176 | 176 | 0.04 | | 41.3 | 17.9 | 1.9 | 1.2 | | 14.2 | 5.5 | 7.1 |
| 36 | EDGEWOOD #2 | 10 73 | 8.0 | 265 | | 169 | 171 | 0.04 | | 37.2 | 19.2 | 3.1 | 2.9 | | 42.4 | 2.5 | 2.7 |
| 37 | EDGEWOOD #3 | 10 73 | 8.1 | 318 | | 165 | 165 | 0.06 | | 42.0 | 14.8 | 3.6 | 1.4 | | 12.1 | 5.5 | 6.2 |
| 42 | WOODED ACRES #3 | 6 67 | 7.3 | | | | 176 | 0.02 | 0.02 | 60.9 | 5.8 | 10.5 | | 189 | 2.2 | 2.5 | 2.7 |
| 44 | GLEN FOREST #1 | 4 66 | 7.3 | | | | 191 | 0.27 | | 56.7 | 12.2 | | | 275 | 3.5 | 5.0 | 29.2 |
| 47 | FOREST LAWN #4 | 12 64 | 7.2 | | | | 252 | 0.20 | | 51.9 | 29.8 | | | 244 | 13.8 | | |
| 48 | GREEN HAVEN HILLS | 11 65 | 8.0 | | | | 119 | 0.01 | | 27.4 | 12.4 | 39.0 | | 126 | 3.3 | 2.3 | 39.4 |
| 52 | HIGHVIEW ACRES #2 | 12 64 | 7.6 | | | | 65 | 0.08 | | 18.6 | 4.6 | 39.8 | | 159 | 12.9 | 1.6 | |
| 57 | BURLINGTON HEIGHTS | 11 73 | 7.8 | 520 | 208 | 141 | 141 | 0.06 | | 48.4 | 5.0 | 6.5 | 0.8 | | 11.8 | 28.5 | |
| 60 | PENN FOREST | 8 64 | 7.5 | | | | 221 | 0.02 | | 37.0 | 31.3 | 0.6 | | 285 | 5.8 | 2.7 | 2.2 |
| 61 | ALGOMA PARK | 5 71 | 8.0 | | | | 76 | 0.06 | 0.02 | 20.6 | 6.0 | 18.9 | | | 18.1 | 6.0 | 0.4 |

NOTE--ALL ZEROS (00.00) - ANALYSED, NOT DETECTED; ALL NINES (99.99) - COULD NOT BE STORED, REFER TO ANALYSIS

VIRGINIA STATE WATER CONTROL BOARD

BUREAU OF SURVEILLANCE AND FIELD STUDIES

SUMMARY OF GROUNDWATER QUALITY ANALYSES FOR ROANOKE COUNTY

| SWCB NO | OWNER AND/OR PLACE | DATE SAMP | PH | SPEC COND | T-DIS SOLID | HARDNESS TOTAL | CA,MG | FE | MN | CA | MG | NA | K | HCO3 | SO4 | CL | NO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 63 | STIDHAM SPRING #1 | 9 39 | 8.2 | | | | 282 | | | 48.8 | 39.0 | | | 181 | 7.4 | 3.5 | |
| 65 | ARLINGTON FOREST | 7 74 | 6.9 | 126 | 129 | 52 | 62 | 0.04 | 0.01 | 17.0 | 4.9 | 8.3 | 1.0 | | 2.6 | 10.0 | 6.2 |
| 65 | ARLINGTON FOREST | 7 65 | 7.2 | | | | 64 | 0.33 | | 20.2 | 3.4 | 7.4 | | 92 | 3.5 | 2.0 | 15.9 |
| 67 | CAROLYN HEIGHTS | 10 73 | 6.8 | 38 | 60 | 14 | 11 | 0.05 | | 2.1 | 1.5 | 4.7 | 1.5 | | | 1.0 | 2.2 |
| 68 | CRESTWOOD PARK #1 | 10 73 | 8.1 | 265 | 188 | 169 | 169 | 0.03 | | 39.0 | 17.4 | 1.4 | 2.6 | | 21.6 | 3.0 | 2.2 |
| 69 | HIGHFIELDS SUB | 1 63 | 8.1 | | | | 77 | 0.02 | | 23.6 | 4.5 | 2.4 | | 82 | 2.6 | 6.0 | 66.5 |
| 71 | LAYMANS LAWN #2 | 8 64 | 6.3 | | | | 27 | 0.02 | 0.04 | 7.2 | 2.1 | 0.1 | | 31 | 0.9 | | |
| 78 | BIG MAUD WELL | 5 64 | 7.8 | | | | 181 | 0.06 | | 39.9 | 19.7 | 7.7 | | 151 | 7.0 | 1.2 | 6.2 |
| 80 | CRYSTAL SPRING | 3 67 | 7.7 | | | | 107 | | | 27.3 | 9.5 | 1.8 | 0.1 | 152 | 3.5 | 4.0 | 8.0 |
| 80 | CRYSTAL SPRING | 5 66 | 7.6 | | | | 120 | | 0.05 | 25.7 | 13.5 | | | 145 | 3.7 | 3.3 | 8.4 |
| 80 | CRYSTAL SPRING | 3 64 | 8.3 | | | | 129 | 0.05 | 0.08 | 28.0 | 14.3 | 3.8 | | 151 | 0.9 | 3.0 | 5.3 |
| 80 | CRYSTAL SPRING | 8 60 | 8.8 | | | | 101 | 0.04 | | 18.2 | 13.6 | 15.2 | | 127 | 1.0 | 2.7 | 0.4 |
| 80 | CRYSTAL SPRING | 3 54 | 7.2 | | | | 138 | 0.08 | 0.06 | 26.8 | 17.2 | | | 145 | 1.2 | 3.3 | 7.1 |
| 81 | BELLE MEADE | 2 58 | 7.2 | | | | 196 | 0.25 | | 44.3 | 20.7 | 3.5 | | 237 | 5.0 | 3.5 | |
| 82 | BELLE MEADE WATER CO | 2 62 | 7.6 | | | | 152 | 0.11 | | 9999.9 | 999.9 | 99999.9 | | | 9999.9 | 99999.9 | 442.6 |
| 83 | BROOKLAWN | 1 64 | 6.9 | | | | | 0.20 | | | | | | 378 | 74.7 | 27.4 | 1.3 |
| 84 | CHESTERFIELD COURT | 12 60 | 7.7 | | | | 124 | 0.06 | | 26.8 | 13.9 | 3.3 | | 155 | 1.1 | 2.2 | 18.6 |
| 92 | HILLANDALE SUB | 6 66 | 7.0 | | | | 350 | 0.14 | 0.05 | 109.2 | 18.8 | | | 314 | 100.0 | 13.3 | |
| 94 | NORTH ARDMORE | 5 67 | 7.6 | | | | 265 | 0.02 | | 58.5 | 29.0 | 3.6 | 0.1 | 269 | 3.4 | 10.0 | 62.9 |
| 97 | NORTH LAKE #2 | 12 10 | 8.4 | | 230 | 78 | 77 | | 0.02 | 28.1 | 1.8 | 52.5 | 2.0 | | 13.0 | 5.0 | |
| 97 | NORTH LAKES #2 | 11 66 | 8.7 | | | | 25 | 0.18 | 0.08 | 5.6 | 2.6 | | | 257 | 5.5 | 1.5 | |
| 98 | NORTH LAKES #3 | 11 66 | 7.8 | | | | 166 | 0.02 | 0.05 | 53.7 | 7.8 | | | 205 | 12.8 | 4.0 | 0.4 |
| 99 | OAK GROVE FARMS | 5 68 | 7.7 | | | | 99 | 0.06 | 0.03 | 23.3 | 10.0 | 1.6 | 1.0 | 128 | 1.6 | 3.0 | 22.6 |
| 100 | STARMOUNT | 5 67 | 8.1 | | | | 180 | 0.08 | | 59.3 | 7.8 | 4.0 | 0.5 | 190 | 22.0 | 3.5 | 0.4 |
| 101 | WINDSOR HILLS | 11 60 | 7.3 | | | | 125 | 0.04 | | 28.0 | 13.3 | | | 134 | 1.7 | 1.8 | 13.3 |
| 101 | WINDSOR HILLS | 11 60 | 7.8 | | | | 148 | 0.05 | | 32.6 | 16.2 | | | 173 | 0.7 | 2.7 | 43.[illegible] |

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V I R G I N I A   S T A T E   W A T E R   C O N T R O L   B O A R D

B U R E A U   O F   S U R V E I L L A N C E   A N D   F I E L D   S T U D I E S

SUMMARY OF GROUNDWATER QUALITY ANALYSES FOR ROANOKE COUNTY

************************************************************************************************

| SWCB NO | OWNER AND/OR PLACE | DATE SAMP | PH | SPEC COND | T-DIS SOLID | HARDNESS TOTAL | CA.MG | FE | MN | CA | MG | NA | K | HCO3 | SO4 | CL | NO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 102 | WINDSOR LAKE | 1 63 | 7.9 | | | | 131 | 0.10 | | | | | | | 7.8 | 6.3 | 2.7 |
| 104 | HOMEWOOD | 7 65 | 7.4 | | | | 41 | 0.08 | | 12.9 | 2.1 | 4.4 | | 61 | 3.3 | 1.0 | 6.6 |
| 107 | GARDEN CITY (SP) | 9 62 | 7.6 | | | | | | | | | | | 31 | 0.4 | 2.1 | 19.9 |
| 110 | HUNTING HILLS #1 | 1 68 | 7.8 | | | | | | 0.14 | 24.1 | | | 0.6 | 390 | | 1.5 | |
| 112 | TOWN OF VINTON | 3 66 | 7.9 | | | | 168 | 0.17 | 0.05 | 44.9 | 13.7 | | | 224 | 20.2 | 0.5 | |
| 116 | WESTERN HILLS | 3 72 | 8.2 | | 156 | 135 | 134 | | 0.01 | 29.6 | 14.8 | 1.1 | 2.6 | | 3.2 | 1.0 | 15.1 |
| 117 | WYNDALE | 10 63 | 7.6 | | | | 145 | | | 30.6 | 16.7 | 1.9 | | 173 | 4.4 | 1.7 | 5.8 |
| 119 | SOUTH SALEM (SP) | 6 64 | 7.9 | | | | 127 | 0.03 | | 27.0 | 14.4 | 39.0 | | 143 | 2.6 | 0.7 | 1.3 |
| 130 | BIOCHEMICAL CORP | 4 75 | 7.7 | | | 176 | 200 | | | 53.0 | 16.5 | 2.2 | 1.4 | | 6.7 | 4.0 | 5.3 |
| 131 | ELI LILLY & CO | 4 75 | 7.6 | | | 190 | 205 | | | 53.0 | 17.9 | 1.8 | 1.0 | | 7.1 | 3.0 | 6.2 |
| 131 | CREATIVE PACKAGING | 3 60 | 7.5 | | | | 337 | | | 90.0 | 27.5 | | | 185 | 6.4 | 3.0 | |
| 131 | CREATIVE PACKAGING | 10 59 | 6.7 | | | | 190 | 3.30 | | 25.6 | 30.7 | 50.9 | | 329 | 26.3 | 27.0 | |
| 131 | CREATIVE PACKAGING | 10 59 | 7.8 | | | | 127 | 0.06 | | 24.0 | 16.3 | 8.2 | | 149 | 10.5 | 8.0 | |
| 132 | CREATIVE PACKAGING | 6 65 | 8.1 | | | | 127 | 0.05 | | 35.0 | 9.6 | 18.0 | | 190 | 4.5 | 4.0 | |
| 133 | DOUBLE ENVELOPE CORP | 4 75 | 7.4 | | | 288 | 406 | 1.40 | 0.05 | 140.0 | 13.8 | 8.3 | 0.2 | | 67.0 | 15.0 | 1.8 |
| 133 | DOUBLE ENVELOPE CORP | 11 63 | 6.9 | | | | 261 | 0.12 | 0.05 | 90.0 | 8.8 | 16.8 | | 273 | 32.6 | 5.7 | 5.8 |
| 134 | DR PEPPER BOTTLING CO | 4 75 | 7.5 | 520 | | 268 | 378 | 0.10 | | 81.0 | 43.0 | 13.9 | 3.6 | | 71.2 | 20.0 | 2.7 |
| 135 | KROGER CO | 6 75 | 7.6 | 310 | | 162 | 165 | | 0.01 | 42.0 | 14.7 | 6.0 | 1.6 | | 14.3 | 11.0 | 6.6 |
| 136 | LEAS & MCVITTY INC | 45 | 7.6 | | | | 219 | 0.03 | | 55.0 | 20.0 | 19.0 | | 203 | 46.0 | 28.0 | 33.2 |
| 139 | LIGHTWEIGHT BLOCK CO | 4 75 | 7.6 | | | 208 | 239 | 0.80 | 0.18 | 64.0 | 19.3 | 3.5 | 3.0 | | 9.7 | 4.0 | 4.9 |
| 142 | ROANOKE MILLS | 10 64 | 7.6 | | | | 168 | | 0.03 | 38.2 | 17.7 | | | 155 | 14.0 | | |
| 145 | SALEM FRAME CO | 4 75 | 7.3 | | | 150 | 221 | 29.00 | 0.02 | 70.0 | 11.4 | 12.4 | 0.6 | | 8.3 | 14.0 | |
| 145 | SALEM FRAME | 4 75 | 7.9 | | | 174 | 244 | 0.10 | 0.01 | 79.0 | 11.6 | 11.2 | 0.6 | | 7.7 | 2.0 | |
| 145 | SALEM FRAME | 3 69 | 8.3 | | | 103 | | 0.02 | | 25.6 | | | | | 6.9 | 2.5 | |
| 148 | VALLEYDALE PACKING CO | 6 75 | 7.4 | 570 | | 304 | 282 | | | 72.0 | 25.0 | 19.0 | 2.5 | | 34.0 | 23.0 | 9.7 |

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VIRGINIA STATE WATER CONTROL BOARD

BUREAU OF SURVEILLANCE AND FIELD STUDIES

SUMMARY OF GROUNDWATER QUALITY ANALYSES FOR ROANOKE COUNTY

| SWCB NO | OWNER AND/OR PLACE | DATE SAMP | PH | SPEC COND | T-DIS SOLID | HARDNESS TOTAL | CA,MG | FE | MN | CA | MG | NA | K | HCO3 | SO4 | CL | NO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 148 | VALLEYDALE PACKING CO | 4 75 | 7.2 | | | | 379 | 0.10 | | 83.0 | 42.0 | 14.1 | 2.3 | | 27.1 | 21.0 | 12.0 |
| 153 | VIRGINIA PLASTICS CO | 6 75 | 7.5 | 270 | | 17 | 144 | | | 34.0 | 14.5 | 2.7 | 1.8 | | 19.4 | 7.0 | 8.0 |
| 154 | YALE AND TOWNE | 6 75 | 7.8 | 630 | | 404 | 757 | 0.30 | | 190.0 | 69.0 | 5.8 | 2.7 | | 278.0 | 4.0 | 4.0 |
| 162 | L H & M R CORP | 7 75 | 7.4 | 350 | | 195 | 186 | | | 57.0 | 10.8 | 10.0 | 1.0 | | 28.0 | 6.0 | 0.9 |
| 165 | ROAKOKE PHOTO FIN. | 4 75 | 7.7 | | | 68 | 83 | | 0.05 | 25.0 | 5.2 | 1.9 | 0.7 | | 12.8 | 3.0 | 0.4 |
| 168 | VA ETNA SPS CO,VINTON | 5 66 | 7.1 | | | | 367 | 0.18 | | 106.2 | 24.7 | | | 128 | 262.9 | 1.8 | 0.4 |
| 168 | VA ETNA SPS CO,VINTON | 5 65 | 7.7 | | | | 373 | 0.17 | 0.03 | 107.8 | 25.4 | 39.0 | | 104 | 268.0 | 1.3 | 0.9 |
| 168 | VA ETNA SPS CO,VINTON | 12 63 | 7.8 | | | | 353 | 0.05 | | 102.0 | 24.0 | 38.5 | | 123 | 272.5 | 1.7 | |
| 168 | VA ETNA SPS CO,VINTON | 10 60 | 7.8 | | | | 344 | 0.04 | | 106.2 | 19.1 | 11.1 | | 129 | 275.3 | 1.3 | 0.4 |
| 169 | DAYS CONST CO | 4 75 | 7.4 | | | 354 | 709 | 0.60 | 0.03 | 230.0 | 33.0 | 16.1 | 1.0 | | 191.0 | 36.0 | |
| 170 | OBS WELL #8,ROANOKE | 2 72 | 7.6 | 730 | 410 | | 330 | 0.02 | | 57.0 | 46.0 | 11.0 | 23.0 | 252 | 130.0 | 13.0 | 0.4 |
| 193 | CATAWBA HOSPITAL | 10 73 | 8.1 | 413 | 233 | 115 | 115 | 0.24 | 0.01 | 21.3 | 15.0 | 15.0 | 1.1 | | 28.2 | 11.5 | |
| 193 | CATAWBA SANATORIUM | 1 51 | 7.6 | | | | 204 | 0.70 | 0.02 | 60.5 | 12.9 | | | 189 | 12.0 | 10.9 | 0.4 |
| 194 | BACK CREEK ELEM SCH | 4 75 | 6.7 | | | 58 | 86 | | 0.01 | 20.0 | 8.8 | 8.5 | 0.5 | | 5.1 | 9.0 | 4.0 |
| 195 | CLEARBROOK ELEM SCH | 4 75 | 6.8 | 170 | | 104 | 98 | 0.10 | | 23.0 | 10.0 | 0.1 | 3.0 | | 1.3 | 4.0 | 9.3 |
| 197 | CAVE SPRING SCHOOL | 4 75 | 6.7 | | | 30 | 45 | 1.00 | 0.03 | 9.0 | 5.5 | 1.2 | 3.4 | | 1.1 | 3.0 | |
| 198 | FORT LEWIS SCHOOL | 5 75 | 7.3 | | | 86 | 96 | | | 24.0 | 9.0 | 3.3 | 0.5 | | 4.0 | | 13.7 |
| 199 | GLENVAR H S | 4 75 | 7.6 | | | 144 | 202 | | | 53.0 | 17.1 | 0.7 | 1.8 | | 2.3 | 3.0 | |
| 200 | MASON COVE SCHOOL | 5 75 | 7.1 | 235 | 170 | 10 | 3 | 0.40 | | 1.0 | 0.2 | 100.0 | | | 15.8 | 2.0 | |
| 201 | MT PLEASANT SCHOOL | 5 75 | 6.9 | 120 | 98 | 42 | 39 | 0.50 | | 9.0 | 4.1 | 7.2 | 1.2 | | 0.5 | | 8.9 |
| 202 | NORTHSIDE INT SCHOOL | 6 75 | 7.6 | 210 | | 104 | 107 | | 0.01 | 31.0 | 7.4 | 8.0 | 0.7 | | 12.0 | 7.0 | |
| 203 | NORTH SIDE H S | 5 75 | 7.5 | | | 100 | 111 | 0.40 | 0.06 | 32.0 | 7.7 | 8.3 | 0.6 | | 3.9 | | |
| 204 | OGDEN REC CENTER | 4 75 | 7.4 | 360 | | 182 | 204 | 0.10 | | 50.0 | 19.3 | 9.9 | 0.9 | | 1.8 | 20.0 | 21.7 |
| 206 | VA SYNOD LUTHERAN HOME | 4 75 | 6.9 | | | 80 | 99 | | | 24.0 | 9.6 | 1.5 | 2.8 | | 2.4 | 2.0 | 4.0 |
| 207 | CAVE SPRING RESCUE SQD | 7 75 | 7.5 | 220 | | 113 | 120 | | | 32.0 | 10.0 | 1.2 | 2.2 | | 2.0 | 1.0 | 4.9 |

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V I R G I N I A   S T A T E   W A T E R   C O N T R O L   B O A R D

B U R E A U   O F   S U R V E I L L A N C E   A N D   F I E L D   S T U D I E S

SUMMARY OF GROUNDWATER QUALITY ANALYSES FOR ROANOKE COUNTY

| SWCB NO | OWNER AND/OR PLACE | DATE SAMP | PH | SPEC COND | T-DIS SOLID | HARDNESS TOTAL | HARDNESS CA,MG | FE | MN | CA | MG | NA | K | HCO3 | SO4 | CL | NO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 209 | S W DURHAM | 5 75 | 7.2 | 150 | | 70 | 79 | 0.10 | | 22.0 | 5.9 | 2.1 | 0.6 | | | | |
| 210 | J B FOUTZ | 5 75 | 7.3 | 310 | 197 | 182 | 177 | | | 41.0 | 18.2 | 2.1 | 0.2 | | | | |
| 211 | JAMES R SWEENEY | 5 75 | 6.1 | 45 | | 20 | 16 | | | 4.0 | 1.5 | 3.2 | 0.8 | | | | |
| 212 | G R WEBB | 5 75 | 6.9 | 160 | | 96 | 98 | | | 24.0 | 9.3 | 1.8 | 0.8 | | | | |
| 218 | SOUTHLAND LIFE INS | 5 75 | 7.5 | | | 244 | 375 | 0.60 | 0.02 | 123.0 | 16.7 | 14.0 | 0.1 | | 49.6 | | |
| 219 | LA BELLEVUE #2 | 11 72 | 6.8 | | 69 | 30 | 29 | 0.09 | | 6.4 | 3.4 | 5.5 | 1.0 | | 1.2 | 2.6 | 10.2 |
| 222 | 7 ELEVEN STORE | 5 75 | 7.5 | | | 10 | 3 | | | 1.0 | 0.3 | 180.0 | | | 39.3 | | |
| 223 | CRAIGHEAD WATER CO | 6 73 | 8.1 | | | | 120 | 0.10 | | | | | | | 1.6 | 4.0 | 4.0 |
| 228 | BROOKLAWN WELL #3 | 9 74 | 7.1 | | | | 292 | 0.05 | 0.05 | 42.9 | 45.1 | 27.9 | | 378 | 34.8 | 5.0 | |
| 236 | R L WINE | 4 74 | 7.6 | | 171 | 152 | 154 | | | 37.0 | 15.0 | 4.8 | 1.7 | | | 2.0 | 10.2 |
| 238 | QUALITY STATION #25 | 5 74 | 6.0 | | | | 21 | 2.00 | | 3.0 | 3.4 | 6.2 | 1.9 | | | | |
| 239 | QUALITY STATION #26 | 5 74 | 5.1 | | | | 4 | 0.10 | | 1.0 | 0.4 | 3.5 | 0.2 | | | | 0.9 |
| 240 | QUALITY STATION #27 | 5 74 | 7.6 | | | | 124 | 3.40 | | 30.0 | 12.0 | 20.0 | 1.1 | | | 3.0 | |
| 241 | QUALITY STATION #28 | 5 74 | 7.0 | | | | 95 | | | 20.0 | 11.0 | 11.0 | 1.0 | | | 5.0 | 0.9 |
| 242 | NORMAN DUELLETTE | 4 74 | 5.7 | | | 6 | 7 | | | 1.0 | 1.2 | | | | | | |
| 243 | C E MOORE | 4 74 | 5.7 | | | 6 | 41 | | 0.01 | 13.0 | 2.3 | | | | | | |
| 244 | PAUL ROBERTS | 6 75 | 7.1 | 260 | | 140 | 101 | 1.30 | 0.13 | 39.0 | 1.1 | 8.0 | 0.6 | | 19.1 | 4.0 | |
| 244 | PAUL ROBERTS | 4 74 | 7.0 | | | 154 | 106 | 1.30 | 0.12 | 41.0 | 1.0 | | | | | 1.0 | |
| 245 | RONALD HOGAN | 4 74 | 7.1 | | | 94 | 72 | 0.40 | 0.15 | 17.0 | 7.2 | | | | | | |
| 246 | STRAUS CONST CO | 4 74 | 7.3 | | | 308 | 341 | 0.10 | 0.01 | 116.0 | 12.6 | | | | | 10.0 | |
| 249 | JORDANTOWN GROCERY | 9 74 | 5.6 | 113 | | 22 | 25 | 0.10 | | 6.0 | 2.5 | 12.2 | 3.1 | | | 11.0 | 31.0 |
| 250 | W A MANSPILE | 1 75 | 7.3 | 540 | | 292 | 266 | 0.90 | 0.01 | 98.0 | 5.3 | 7.5 | | | 2.0 | 9.0 | |
| 251 | LOCATED AT HOLLINS | 1 75 | 7.2 | 140 | | 66 | 70 | 0.30 | | 20.0 | 4.9 | 2.1 | 0.6 | | 15.0 | 4.0 | 0.9 |

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V I R G I N I A   S T A T E   W A T E R   C O N T R O L   B O A R D

B U R E A U   O F   S U R V E I L L A N C E   A N D   F I E L D   S T U D I E S

SUMMARY OF GROUNDWATER QUALITY ANALYSES FOR ROANOKE COUNTY

| SWCB NO | OWNER AND/OR PLACE | DATE SAMP | PH | SPEC COND | T-DIS SOLID | HARDNESS TOTAL | CA,MG | FE | MN | CA | MG | NA | K | HCO3 | SO4 | CL | NO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 254 | ATLAS POWDER CO | 3 75 | 7.3 | 210 | | 120 | 148 | 0.30 | 0.01 | 41.0 | 11.3 | 2.8 | 1.5 | | 3.7 | 5.0 | 9.7 |
| 254 | ATLAS POWDER CO | 6 75 | 6.5 | 75 | | 42 | 31 | 0.30 | 0.01 | 6.0 | 3.9 | 5.6 | 0.7 | | 3.4 | 1.0 | 0.9 |
| 255 | JOHN A HALL & CO | 5 75 | 7.7 | 390 | | 238 | 216 | | | 57.0 | 18.1 | 2.5 | 1.0 | | | | |
| 255 | JOHN A HALL & CO | 3 75 | 7.1 | 210 | | 120 | 147 | 0.10 | 0.01 | 40.0 | 11.6 | 1.3 | 2.0 | | 1.3 | 14.0 | 6.2 |
| 256 | SALEM STONE CORP | 5 75 | 7.7 | | | 362 | 463 | 0.50 | | 82.0 | 63.0 | 90.0 | 1.5 | | 104.0 | | |
| 259 | HOUSTON TURNER | 5 75 | 7.2 | | | 178 | 176 | | | 46.0 | 14.9 | 2.3 | 0.9 | | 8.8 | | 1.3 |
| 262 | SCENIC HILLS #1 | 10 73 | 7.1 | 58 | 47 | 29 | 28 | 0.03 | 0.01 | 7.6 | 2.4 | 3.9 | 0.7 | | 0.8 | 25.0 | |
| 264 | MT PLEASANT WATER CORP | 3 68 | 8.1 | | 193 | 115 | 103 | 0.10 | 0.02 | 24.0 | 10.5 | 20.0 | 4.5 | | 5.2 | 70.0 | 11.5 |
| 265 | EDGEWOOD #4 | 10 73 | 8.2 | 279 | 180 | 194 | 197 | 0.02 | 0.01 | 41.1 | 23.1 | 0.9 | 3.0 | | 9.8 | 2.0 | 2.7 |
| 266 | EDGEWOOD #5 | 10 73 | 8.1 | 388 | 176 | 183 | 185 | 0.06 | | 55.7 | 11.1 | 2.4 | 1.8 | | 14.0 | 9.0 | 4.4 |
| 267 | CARVINS COVE | 3 73 | 7.8 | | 77 | | 51 | 0.10 | 0.01 | 15.0 | 3.3 | 1.5 | 1.1 | | 12.9 | 3.7 | |
| 269 | BLUE RIDGE PARK COMP | 3 69 | 8.1 | | | 110 | | 0.02 | 0.01 | 24.0 | | | | | 12.6 | 4.0 | |
| 270 | WHITE OAK ESTATES #2 | 7 74 | 7.7 | 433 | 38200 | | 206 | | | 80.0 | 1.6 | 15.5 | 1.2 | | | 11.0 | |
| 270 | WHITE OAK ESTATES #2 | 11 73 | 8.3 | 162 | 147 | 122 | 117 | 0.28 | 0.02 | 25.2 | 13.2 | 0.7 | 3.2 | | 4.0 | 1.0 | |
| 272 | BOTETOURT FOREST | 9 72 | 8.3 | | 128 | 106 | 105 | 0.12 | 0.02 | 22.4 | 12.1 | 1.0 | 1.8 | | 1.2 | 0.5 | 4.0 |
| 273 | DALEVILLE FARMS #1 | 9 74 | 7.5 | 155 | 105 | | 71 | 0.50 | | 22.0 | 4.0 | 6.8 | 4.3 | | | 6.0 | |
| 273 | DALEVILLE FARMS #1 | 7 70 | 7.6 | | 279 | 260 | 254 | 0.02 | | 75.3 | 16.0 | | | | 48.0 | 3.0 | 0.4 |
| 276 | VA BAPT CHILDRENS HOME | 1 73 | 7.9 | 180 | 127 | 110 | 109 | 0.03 | | 37.0 | 4.1 | 6.5 | 0.4 | | 10.0 | 10.5 | 0.9 |
| 278 | TANGLEWOOD SOUTH #1 | 3 73 | 8.0 | | 143 | | 137 | 0.20 | | 28.8 | 16.0 | 1.2 | 1.8 | | 2.0 | 1.0 | 2.2 |
| 279 | TANGLEWOOD SOUTH #2 | 3 73 | 7.7 | | 123 | | 121 | 0.10 | | 28.1 | 12.5 | 0.6 | 2.0 | | 3.7 | 2.6 | 4.4 |
| 280 | SUNCREST HEIGHTS | 3 56 | 7.5 | | | 120 | | 0.90 | | 58.0 | | | | | 25.5 | 9.7 | |
| 280 | SUNCREST HEIGHTS | 3 74 | 7.9 | 252 | 155 | 131 | 127 | 0.05 | 0.02 | 24.0 | 15.9 | 4.6 | 1.6 | | 5.4 | 10.0 | 4.9 |
| 283 | J R LAPRADE | 4 75 | 7.5 | 410 | 286 | 38 | 5 | | 0.01 | 2.0 | 0.1 | 107.0 | 0.1 | | 13.8 | 1.0 | 0.9 |
| 286 | H A GROSS INC | 5 75 | 7.5 | | | 184 | 201 | | | 57.0 | 14.4 | 1.2 | 0.9 | | 4.2 | | 1.[illegible] |

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| SWCB NO | OWNER AND/OR PLACE | DATE SAMP | PH | SPEC COND | T-DIS SOLID | HARDNESS TOTAL | HARDNESS CA,MG | FE | MN | CA | MG | NA | K | HCO3 | SO4 | CL | NO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 287 | ACORN CONST CO | 5 75 | 7.3 | | | 172 | 190 | 0.10 | | 62.0 | 8.8 | 2.3 | 0.4 | | 19.9 | | 0.9 |
| 297 | BOB BURNLEY | 5 75 | 6.2 | | | 24 | 25 | 0.10 | | 8.0 | 1.3 | 6.6 | 0.7 | | 5.9 | | |
| 297 | R G BURNLEY | 4 74 | 6.2 | | 85 | 40 | 26 | | | 8.0 | 1.5 | 8.5 | 0.8 | | | 2.0 | |
| 311 | I SUTPHIN | 7 75 | 7.7 | 420 | | 273 | 224 | | | 44.0 | 28.0 | 3.0 | 2.6 | | 28.9 | 5.0 | 6.6 |
| 317 | B DUNFORD | 8 75 | 7.3 | 345 | | 106 | 109 | 3.30 | 0.61 | 24.0 | 12.0 | 42.0 | 0.9 | | 34.6 | 13.0 | |
| 318 | P W MC DANIEL | 8 75 | 7.3 | 250 | | 122 | 144 | | | 48.0 | 6.1 | 2.6 | 0.8 | | 20.5 | 1.0 | |
| 319 | L ALLS | 8 75 | 7.4 | 400 | | 220 | 252 | 0.10 | 0.01 | 55.0 | 28.0 | 1.6 | 1.4 | | 10.8 | 2.0 | 4.9 |
| 320 | C M GORMAN | 8 75 | 7.4 | 410 | | 142 | 247 | | | 90.0 | 5.5 | 4.2 | 1.2 | | 21.0 | 2.0 | 1.8 |
| 321 | E FRANCISCO | 8 75 | 7.4 | 380 | | 208 | 212 | | 0.02 | 80.0 | 3.1 | 5.0 | 0.3 | | 18.2 | 6.0 | 14.2 |
| 326 | L W BOITNOTT | 8 75 | 7.6 | 410 | | 212 | 214 | 0.10 | | 56.0 | 18.1 | 1.0 | 0.7 | | 28.8 | 12.0 | 3.5 |
| 327 | FRANK H JOHNSON | 8 75 | 7.6 | 410 | | 198 | 203 | 0.10 | 0.01 | 53.0 | 17.3 | 8.0 | 0.6 | | 14.5 | 13.0 | 7.5 |
| 328 | WALDRON FARMS | 8 75 | 7.4 | 400 | | 202 | 211 | 0.10 | | 58.0 | 16.2 | | 0.7 | | 27.4 | 14.0 | 10.2 |
| 329 | E L MULLINS | 3 75 | 8.6 | 350 | 226 | 12 | 15 | | 0.02 | 4.0 | 1.3 | 68.0 | 0.4 | | | | |
| 330 | C A ASSAID | 3 75 | 6.6 | 146 | 105 | 24 | 30 | 2.40 | 0.40 | 7.0 | 3.1 | 25.0 | 1.7 | | | | 3.1 |
| 331 | FRANK SCHILLIAT | 3 75 | 6.9 | 230 | | 6 | 83 | 2.90 | 0.12 | 24.0 | 5.8 | 50.0 | 0.6 | | | 0.6 | |
| 332 | LOCK HAVEN CO CLUB | 3 75 | 7.3 | 425 | 293 | 116 | 299 | | 0.02 | 111.0 | 5.5 | 3.7 | 0.3 | | | | 0.9 |
| 335 | DAVID HAMBLIN | 8 75 | 7.4 | 270 | | 130 | 147 | 0.10 | | 53.0 | 3.6 | | 0.5 | | 9.2 | 4.0 | 17.7 |
| 336 | D T RADER | 8 75 | 7.4 | 260 | | 122 | 133 | 0.10 | 0.01 | 34.0 | 11.8 | | 2.2 | | 16.8 | 9.0 | 11.1 |
| 337 | FOUTZ | 8 75 | 7.4 | 620 | | 248 | 292 | 0.20 | 0.02 | 66.0 | 31.0 | 24.0 | 4.1 | | 69.6 | 41.0 | 5.8 |
| 338 | E R GIBSON | 8 75 | 7.5 | 400 | | 188 | 202 | 0.10 | | 50.0 | 19.0 | | 3.0 | | 26.6 | 8.0 | 6.6 |
| 339 | HENRY FLIPPEN | 8 75 | 7.3 | 480 | | 226 | 240 | | | 55.0 | 25.0 | 5.0 | 3.5 | | 21.5 | 6.0 | 22.2 |

NOTE--ALL ZEROS (00.00) - ANALYSED, NOT DETECTED; ALL NINES (99.99) - COULD NOT BE STORED, REFER TO ANALYSIS

# APPENDIX B

## SUMMARY OF WATER WELL DATA FOR ROANOKE COUNTY

The computer printout on the following pages lists basic well data for wells in Roanoke County. This printout is updated frequently to include information from new Water Well Completion Reports which are constantly being submitted by water well drillers. The information under the heading "Aquifer" may be cross-referenced with Table 2, Chapter III.

VIRGINIA STATE WATER CONTROL BOARD

BUREAU OF WATER CONTROL MANAGEMENT

SUMMARY OF WATER WELL DATA FOR ROANOKE COUNTY

**************************************************************************************************

THE FOLLOWING LIST OF WELL DATA SUMMARIZES BASIC DATA OBTAINED FROM WATER WELL COMPLETION REPORTS WHICH ARE ON PERMANENT FILE IN THE OFFICES OF THE VIRGINIA STATE WATER CONTROL BOARD. ADDITIONAL INFORMATION FOR MANY OF THE WELLS IS AVAILABLE AND CAN BE OBTAINED BY CONTACTING THE APPROPRIATE REGIONAL OFFICE OR THE BUREAU OF WATER CONTROL MANAGEMENT AT THE AGENCY HEADQUARTERS IN RICHMOND.

************ EXPLANATION OF PARAMETERS ************

SWCB NO: STATE WATER CONTROL BOARD NUMBER - A SEQUENTIAL NUMBERING SYSTEM USED WITHIN A COUNTY; WHEN REFERRING TO A SPECIFIC WELL USE THIS NUMBER

OWNER AND/OR PLACE: IDENTIFIES ORIGINAL OR CURRENT WELL OWNER AND/OR LOCATION OF WELL

YEAR COMP: YEAR IN WHICH WELL CONSTRUCTION WAS COMPLETED

LOG: TYPE OF LOG ON FILE FOR WELL; D = DRILLERS, E = ELECTRIC, G = GEOLOGIC

ELEV: ELEVATION - MEASURED IN FEET ABOVE MEAN SEA LEVEL

TOTAL DEPTH: TOTAL DEPTH DRILLED, IN FEET, WITH RESPECT TO LAND SURFACE

BEDROCK: DEPTH TO BEDROCK, IN FEET, WITH RESPECT TO LAND SURFACE

CASING: MAXIMUM AND MINIMUM DIAMETER OF CASING, IN INCHES, USED IN WELL

DEVEL ZONE: DEVELOPED ZONE - INTERVALS, IN FEET, WHERE AQUIFERS TAPPED AND/OR SCREENED

AQUIFER: WATER-BEARING UNIT; ABBREVIATIONS USED INDICATE GEOLOGIC AGE OF UNIT AND ARE CONSISTENT WITH "GEOLOGIC MAP OF VIRGINIA" (DIVISION OF MINERAL RESOURCES - 1963)

STATIC LEVEL: DEPTH, IN FEET, TO WATER WITH RESPECT TO LAND SURFACE; MEASUREMENTS TAKEN WHEN WELL IS NOT PUMPED AND ARE GENERALLY THOSE RECORDED ON COMPLETION DATE

YIELD: REPORTED OR MEASURED PRODUCTION, IN GALLONS PER MINUTE

DRAWDOWN: DIFFERENCE, IN FEET, BETWEEN STATIC LEVEL AND PUMPING LEVEL; I.E., REPORTED OR MEASURED DROP, IN FEET, IN WATER LEVEL DUE TO PUMPING

SPEC CAPAC: SPECIFIC CAPACITY - YIELD PER UNIT OF DRAWDOWN EXPRESSED AS GALLONS PER MINUTE PER FOOT OF DRAWDOWN

HRS: HOURS - DURATION OF PUMP TEST, IN HOURS, FROM WHICH THE PRECEDING THREE ITEMS WERE DERIVED

USE: USE OF WATER OR WELL UNDER CONSIDERATION; DOM = DOMESTIC, PUB = PUBLIC, GOV = GOVERNMENT, IND = INDUSTRIAL, COM = COMMERCIAL, INS = INSTITUTIONAL, ABD = ABANDONED, DST = DESTROYED, IRR = IRRIGATION, RCH = ARTIFICIAL RECHARGE

VIRGINIA STATE WATER CONTROL BOARD

BUREAU OF WATER CONTROL MANAGEMENT

SUMMARY OF WATER WELL DATA FOR ROANOKE COUNTY

| SWCB NO | OWNER AND/OR PLACE | YEAR COMP | LOG | ELEV | TOTAL DEPTH | BED-ROCK | CASING MAX | CASING MIN | DEVEL FROM | ZONE TO | AQUIFER | STATIC LEVEL | YIELD | DRAW DOWN |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | ANDREW LEWIS WTR WKS | | | | | | | | | | CE | | | |
| 2 | BONNIE SHERRY WTR CO DEEP WELL | 50 | D | 1130 | 221 | 25 | 6 | | 100 | 221 | CE | 86 | 10 | |
| 3 | HC & CR BOWLING FORT LEWIS TERRACE | 48 | | | | | | | | | CE | | | |
| 4 | BROADVIEW WATER WORKS | 55 | | 1140 | 263 | 50 | | 6 | | | CE | 97 | | |
| 5 | MARTIN,BROOKWOOD DEV | 69 | D | 1260 | 525 | 70 | 6 | | | | PCV | | 6 | |
| 6 | BROOKWOOD DEV | 70 | D | 1260 | 325 | 64 | 8 | | | | PCV | 10 | 21 | |
| 7 | BROOKWOOD DEV | 72 | D | 1260 | 265 | 9 | 8 | | | | PCV | | 18 | 189 |
| 8 | CASTLE ROCK WATER CO | 60 | D | 1380 | 501 | 104 | 8 | | 300 | 360 | CR | 270 | 50 | 18 |
| 9 | CASTLE ROCK WATER CO CASTLE RK OREANDERP | 63 | D | 1320 | 350 | 20 | 8 | | 225 | 227 | CR | 3 | 77 | 200 |
| 10 | CASTLE ROCK WATER CO FAMINGTON LAKES | 57 | | 1100 | 503 | 55 | 8 | | | | CR | | 80 | |
| 11 | CASTLE ROCK WATER CO OREANDER PARK | 57 | | 1160 | 204 | 80 | 6 | | | | CR | | 50 | |
| 12 | MR SLOVINSKY | 64 | | | 305 | 56 | 6 | | | | CR | 2 | 90 | |
| 13 | CHAPMAN,RICE, INC FORT LEWIS PLACE | 48 | | 1110 | 297 | 56 | 10 | | 217 | 227 | CE | 82 | 88 | |
| 14 | COVEHAVEN COURT WTR C | 55 | D | 1100 | 262 | 60 | 6 | | | | CE | | 40 | |
| 15 | CRESCENT HTS WTR CO | 63 | | 1290 | 257 | | 6 | | | | CR | 70 | 60 | |
| 16 | CRESCENT HTS WTR CO | 63 | | 1290 | 235 | | 6 | | | | CR | 70 | 20 | |
| 17 | EF CYPHERS,WESTBROOK | | | 1070 | | | | | | | CE | | | |
| 18 | C E DAVIDSON BELLE HAVEN | | | 1270 | 130 | | | | | | ORDOV | | | |
| 20 | DEMONSTRATION WTR PRJ | 70 | D | 1090 | 320 | 103 | 6 | | 100 | 110 | CE | 50 | 30 | |
| 21 | DEMONSTRATION WTR PRJ HOLLINS COMMUNITY | 71 | D | 1120 | 185 | 1 | 6 | | | | OE | | 75 | |
| 22 | DEMONSTRATION WTR PRJ PERDUE PROPERTY | 71 | D | 1180 | 360 | 110 | 6 | | 300 | 310 | CS | 100 | 16 | |
| 23 | DEMONSTRATION WTR PRJ PERDUE PROPERTY | 71 | D | 1260 | 580 | 113 | 6 | | 550 | 555 | CS | 100 | 45 | 450 |
| 24 | DEMONSTRATION WTR PRJ SOUTHERN HILLS | 70 | D | 1340 | 480 | 60 | 6 | | 300 | 360 | CS | 200 | 30 | 160 |
| 25 | DEMONSTRATION WTR PRJ SOUTHERN HILLS | 70 | D | 1340 | 340 | 60 | 6 | | 295 | 310 | CS | 100 | 30 | 100 |
| 26 | DEMONSTRATION WTR PRJ NEW HOPE | 71 | D | 1340 | 525 | 1 | | | 240 | 525 | CS | | | |
| 27 | DEMONSTRATION WTR PRJ | | D | | 345 | 65 | | | | | | | | |
| 29 | P G DIVERS SHERRY COURT | 56 | D | 1180 | 260 | 480 | 6 | | | | ORDOV | 450 | 15 | |
| 30 | BESSIE Y DUFFY SUNSET VILLAGE | 49 | D | 1080 | 202 | 170 | 6 | | 202 | | CR | 75 | 20 | 15 |
| 31 | DURHAM WATER CO ORCHARD HEIGHTS | 57 | | 1080 | 500 | 120 | 6 | | | | CR | | 60 | |

VIRGINIA STATE WATER CONTROL BOARD

BUREAU OF WATER CONTROL MANAGEMENT

SUMMARY OF WATER WELL DATA FOR ROANOKE COUNTY

| SWCB NO | OWNER AND/OR PLACE | YEAR COMP | LOG | ELEV | TOTAL DEPTH | BED-ROCK | CASING MAX MIN | DEVEL FROM | ZONE TO | AQUIFER | STATIC LEVEL | YIELD | DRAW DOWN | SPEC CAPAC | HRS | USE |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 32 | DURHAM WATER CO | 57 | | 1130 | 353 | 221 | 6 | | | CR | 210 | 13 | 2 | 6.50 | 1 | PUB |
| | ORCHARD HEIGHTS | | | | | | | | | | | | | | | |
| 33 | DWIGHT HILLS WATER CO | 56 | | 1100 | 130 | 20 | 6 | 120 | 130 | OE | 110 | 40 | 50 | .80 | 2 | PUB |
| 34 | EDGEWOOD WATER CO #1 | 28 | | 1020 | 90 | | 6 | | | CR | 22 | 35 | | | | PUB |
| 35 | EDGEWOOD WATER CO #1A | 32 | | 1020 | 70 | | 6 | | | CR | 10 | 50 | 5 | 10.00 | | PUB |
| 36 | EDGEWOOD WATER CO #2 | 58 | | 1100 | 320 | | 6 | | | CR | 115 | 17 | | | | PUB |
| 37 | EDGEWOOD WATER CO #3 | 62 | | 1155 | 225 | 75 | 6 | 215 | 216 | CS | 115 | 25 | 53 | .47 | | PUB |
| 38 | EDGEWOOD WATER CO #4 | 62 | D | 1110 | 275 | 105 | 6 | | | CE | 90 | 12 | | | | ABD |
| 39 | ELOISE GRAVES | 51 | | 1410 | 212 | 870 | 6 | | | PCV | | 15 | | | | PUB |
| 40 | FAIRDALE CONST CO | 58 | | 1395 | 260 | 50 | 6 | | | OE | 50 | 5 | | | | PUB |
| | WOODED ACRES | | | | | | | | | | | | | | | |
| 41 | FAIRDALE CONST CO | 58 | | 1360 | 190 | | 6 | | | OE | | 30 | | | | PUB |
| | WOODED ACRES | | | | | | | | | | | | | | | |
| 42 | FAIRDALE CONST CO | 65 | | 1315 | 108 | | 6 | | | OE | 30 | 20 | | | | PUB |
| | WOODED ACRES | | | | | | | | | | | | | | | |
| 43 | FARMING DALE WATER CO | 55 | | 1020 | 502 | 104 | 8 | | | CE | 50 | 56 | | | | PUB |
| 44 | MACK FISHER | 64 | | 1270 | 200 | 481 | 6 | | | CE | 130 | 20 | | | | PUB |
| | GLEN FOREST SUB | | | | | | | | | | | | | | | |
| 45 | FRALIN & WALDREN | 66 | D | | 445 | 30 | 8 | | | | 43 | 440 | 60 | 7.33 | | PUB |
| 46 | FRALIN & WALDREN | 69 | D | | 440 | 47 | 10 | | | | 90 | 400 | | | | PUB |
| 47 | FREY CORP FOREST LAWN | | | | | | | | | CE | | | | | | PUB |
| 48 | GREEN HAVEN HILLS UTL | 56 | | 1200 | 335 | | | | | CR | 115 | 5 | 20 | .25 | 14 | PUB |
| 49 | GREENRIDGE WATER CO | 55 | | 1160 | 714 | 100 | 6 | | | OE | | 20 | | | | PUB |
| | LEMONTON SUB | | | | | | | | | | | | | | | |
| 50 | GREENRIDGE WATER CO | 62 | G | 1150 | 664 | 8 | 6 | | | OE | 50 | 15 | | | | PUB |
| | LEMONTON SUB | | | | | | | | | | | | | | | |
| 51 | HIGH VIEW WATER CO | 59 | | 1800 | 800 | 5 | 6 | | | OE | | 5 | | | | PUB |
| | HIGH VIEW ACRES | | | | | | | | | | | | | | | |
| 52 | HIGH VIEW WATER CO | 59 | | 1800 | 800 | | 6 | | | OE | | 5 | | | | PUB |
| | HIGH VIEW ACRES | | | | | | | | | | | | | | | |
| 53 | LINDENWOOD WATER CO | 56 | D | 1180 | 254 | 37 | 6 | | | PCV | 45 | 30 | | | | PUB |
| | LINDENWOOD SUB | | | | | | | | | | | | | | | |
| 54 | LINDENWOOD WATER CO | 58 | D | 1160 | 84 | 37 | 6 | | | PCV | 15 | 40 | | | 10 | PUB |
| | LINDENWOOD SUB | | | | | | | | | | | | | | | |
| 55 | LINDENWOOD WATER CO | 59 | D | 1180 | 485 | 50 | 6 | | | PCV | 35 | 30 | | | 24 | PUB |
| | LINDENWOOD SUB | | | | | | | | | | | | | | | |
| 56 | MOUNTAIN SPRING WTR C | 59 | | 1700 | 355 | 50 | 8 | | | DCH | | 50 | | | | PUB |
| | WESTARD LAKE ESTA | | | | | | | | | | | | | | | |
| 57 | JOSEPH N NACKLEY | 58 | | 1095 | 166 | | 6 | | | OE CE | 40 | 14 | | | | PUB |
| | BURLINGTON HEIGHTS | | | | | | | | | | | | | | | |
| 58 | GROVE NEAL | 57 | | 1340 | 248 | | 6 | | | CE | | 20 | | | | PUB |
| | SCENERY COURT | | | | | | | | | | | | | | | |
| 59 | OTTERVIEW GARD WTR CO | 62 | D | 1155 | 350 | 57 | 6 | 88 | 99 | CE | 45 | 25 | 112 | .22 | 75 | PUB |
| 60 | PENN FOREST WATER COR | 63 | D | 1170 | 472 | 47 | 8 | 130 | 135 | PCVCCH | 69 | 49 | 273 | .17 | 36 | PUB |
| | PENN FOREST | | | | | | | | | | | | | | | |

# VIRGINIA STATE WATER CONTROL BOARD

## BUREAU OF WATER CONTROL MANAGEMENT

### SUMMARY OF WATER WELL DATA FOR ROANOKE COUNTY

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| SWCB NO | OWNER AND/OR PLACE | YEAR COMP | LOG | ELEV | TOTAL DEPTH | BED-ROCK | CASING MAX MIN | DEVEL FROM | ZONE TO | AQUIFER | STATIC LEVEL | YIELD | DRAW DOWN | SPEC CAPAC | HRS | USE |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 61 | PENN FOREST WATER COR<br>ALGOMA PARK | 64 | D | 1080 | 305 | 10 | 8 | 295 | 300 | CR | 39 | 90 | 46 | 1.95 | 157 | PUB |
| 62 | PENN FOREST WATER COR<br>STARKEY | 66 | | 1200 | 440 | | 8 | | | CS | 43 | 440 | 60 | 7.33 | 36 | PUB |
| 63 | J N PHELPS STIDHAM SP | | | 1020 | | | | | | CE | | | | | | PUB |
| 64 | J N PHELPS STIDHAM SP | | | 1020 | | | | | | CE | | | | | | PUB |
| 65 | R E J WATER CORP<br>ARLINGTON FOREST | 64 | D | 1250 | 236 | 72 | 6 | 85 | 90 | PCV | 35 | 43 | 90 | .47 | 72 | PUB |
| 66 | R E J WATER CORP<br>ARLINGTON HILLS | 56 | D | 1280 | 200 | 63 | 6 | | | PCV | 80 | 43 | 20 | 2.15 | 24 | PUB |
| 67 | K E J WATER CORP<br>CAROLYN HEIGHTS | 59 | D | 1230 | 95 | 18 | 6 | | | CR | | 20 | | | 24 | PUB |
| 68 | R E J WATER CORP<br>CRESTWOOD PARK | | D | | | 318 | 8 | 270 | 271 | | | 40 | | | 24 | PUB |
| 69 | R E J WATER CORP<br>HIGHFIELDS SUB | 57 | D | 1296 | 212 | 52 | 6 | | | PCV | 24 | 35 | | | 12 | PUB |
| 70 | R E J WATER CORP<br>LAYMANS LAWN | 57 | D | 1255 | 227 | 55 | 6 | | | PCV | 65 | 45 | | | 12 | PUB |
| 71 | R E J WATER CORP<br>LAYMANS LAWN | 63 | D | 1130 | 283 | 45 | 6 | 155 | 180 | PCV | 65 | 20 | | | | PUB |
| 72 | R E J WATER CORP | 72 | | | 375 | | 6 | | | | 58 | 135 | | | | PUB |
| 73 | RIDGEWOOD HTS WTR CO | 58 | | 1170 | 490 | | 8 | | | CR | 116 | 20 | | | | PUB |
| 74 | RIDGEWOOD HTS WTR CO | 58 | D | 1130 | 621 | | 6 | | | CR | 115 | 100 | | | 6 | PUB |
| 75 | CITY OF ROANOKE | | | 1190 | 520 | 77 | 8 | | | CR | 96 | | | | 19 | ABD |
| 76 | CITY OF ROANOKE<br>GREEN VALLEY | 56 | | 1140 | 204 | 46 | 6 | 155 | 180 | | | 26 | | | | ABD |
| 77 | CITY OF ROANOKE<br>GREEN VALLEY | 56 | D | 1190 | 520 | 77 | 8 | | | CR | 96 | 41 | 79 | .51 | 19 | ABD |
| 78 | CITY OF ROANOKE | 57 | D | | 301 | 146 | 10 | | | | 55 | 150 | 50 | 3.00 | 24 | ABD |
| 79 | CITY OF ROANOKE | 66 | D | | 450 | 100 | 8 | | | | 10 | 94 | 37 | 2.54 | 72 | ABD |
| 80 | CITY OF ROANOKE<br>CRYSTAL SPRING | | | | | | | | | | | 2780 | | | | PUB |
| 81 | ROANOKE CO PUB SER AU<br>BELLE MEADE | 56 | D | 1170 | 311 | 50 | 8 | | | CR | | 50 | | | | PUB |
| 82 | ROANOKE CO PUB SER AU<br>BELLE MEADE | 58 | D | 1170 | 335 | | 6 | | | ORDOV | 88 | 55 | 85 | .64 | | PUB |
| 83 | ROAN CO PSA BROOKLAWN | 56 | | 1165 | 180 | | 6 | | | ORDOV | | | | | | PUB |
| 84 | ROANOKE COUNTY PSA<br>CHESTERFIELD COURT | 54 | | 1330 | 500 | 80 | | | | CCH | 250 | 22 | | | 72 | PUB |
| 85 | ROANOKE COUNTY PSA<br>HIDDEN VALLEY #1 | 62 | D | 1360 | 260 | 21 | 8 | 200 | 201 | PCV | 122 | 35 | | | 60 | PUB |
| 86 | ROANOKE COUNTY PSA<br>HIDDEN VALLEY #2 | 59 | | 1350 | 307 | | 8 | | | CR | 108 | 86 | 100 | .86 | 25 | PUB |
| 87 | ROANOKE COUNTY PSA<br>HIDDEN VALLEY #3 | 61 | D | 1420 | 503 | 25 | 8 | 286 | 287 | CCH | 120 | 44 | 400 | .11 | 72 | PUB |

V I R G I N I A   S T A T E   W A T E R   C O N T R O L   B O A R D

B U R E A U   O F   W A T E R   C O N T R O L   M A N A G E M E N T

SUMMARY OF WATER WELL DATA FOR ROANOKE COUNTY

| SWCB NO | OWNER AND/OR PLACE | YEAR COMP | LOG | ELEV | TOTAL DEPTH | BED-ROCK | CASING MAX | CASING MIN | DEVEL FROM | ZONE TO | AQUIFER | STATIC LEVEL | YIELD | DRAW DOWN | SPEC CAPAC | HRS | USE |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 88 | ROANOKE COUNTY PSA HIDDEN VALLEY #4 | 62 | D | 1300 | 338 | 23 | 8 | | 91 | 93 | CCH | 76 | 68 | 215 | .31 | 36 | PUB |
| 89 | ROANOKE COUNTY PSA HIDDEN VALLEY #4 | 63 | D | 1155 | 197 | 96 | 8 | | 145 | 182 | CR | 13 | 85 | 46 | 1.84 | 30 | PUB |
| 90 | ROANOKE COUNTY PSA HIDDEN VALLEY #5 | 56 | D | 1140 | 360 | 75 | 6 | | 240 | 350 | CR | 73 | 50 | | | 25 | PUB |
| 91 | ROANOKE COUNTY PSA HIDDEN VALLEY #6 | 60 | | 1180 | 360 | 192 | 8 | | 180 | 210 | CR | 180 | 80 | 100 | .80 | 24 | PUB |
| 92 | ROANOKE COUNTY PSA HILLENDALE | 65 | D | 1140 | 310 | 20 | 6 | | 224 | 280 | CE | 5 | 60 | 55 | 1.09 | 6 | PUB |
| 93 | ROANOKE COUNTY PSA MEDMONT LAKE SUB | 57 | D | 1060 | 381 | 40 | 6 | | | | CR | | 45 | | | | PUB |
| 94 | ROANOKE COUNTY PSA NORTH ARDMORE | 57 | | 1240 | 253 | | 6 | | | | OCK | | | | | | PUB |
| 95 | ROANOKE COUNTY PSA NORTH ARDMORE | 67 | | 1140 | 315 | | 6 | | 195 | 315 | OCK | 122 | 72 | 30 | 2.40 | 18 | PUB |
| 96 | ROANOKE COUNTY PSA NORTH LAKES SUB | 62 | D | 1185 | 268 | 40 | 8 | | 90 | 91 | OE | 29 | 40 | 81 | .49 | 48 | PUB |
| 97 | ROANOKE COUNTY PSA NORTH LAKES SUB | 65 | D | 1150 | 500 | 20 | 8 | | 100 | 105 | OE | 22 | 47 | 357 | .13 | 48 | PUB |
| 98 | ROANOKE COUNTY PSA NORTH LAKES SUB | 65 | D | 1155 | 250 | 10 | 8 | | 75 | 80 | OE | 33 | 60 | 225 | .26 | 48 | PUB |
| 99 | ROANOKE COUNTY PSA OAK GROVE FARMS | 66 | D | 1130 | 421 | 96 | 8 | | 200 | 215 | CR | 68 | 165 | 32 | 5.15 | 72 | PUB |
| 100 | ROANOKE COUNTY PSA STARMOUNT SUB | 53 | D | 1125 | 146 | 42 | 6 | | | | OE | 27 | 30 | | | | PUB |
| 101 | ROANOKE COUNTY PSA WINDSOR HILLS SUB | 49 | D | 1110 | 164 | 90 | 8 | | 130 | 150 | CR | 70 | 60 | 58 | 1.03 | 60 | PUB |
| 102 | ROANOKE COUNTY PSA WINDSOR LAKE SUB | 61 | D | 1110 | 448 | 45 | 8 | | 106 | 107 | CR | 28 | 90 | 69 | 1.30 | 72 | PUB |
| 103 | ROANOKE COUNTY PSA | 69 | D | 1030 | 500 | | 6 | | | | CR | 28 | 65 | 318 | .20 | 72 | PUB |
| 104 | ROSELAWN FOREST INC HOMEWOOD | 64 | D | 1480 | 354 | 55 | 6 | | 260 | 270 | PCV | 80 | 10 | | | | PUB |
| 105 | RICHARD W SLOAN | 70 | D | 1260 | 127 | 60 | 6 | | 70 | 71 | PCV | 20 | 20 | | | | PUB |
| 106 | TESTER BROTHERS | 69 | D | 1200 | 310 | | 6 | | 195 | 200 | CE | 160 | 30 | | | 75 | PUB |
| 107 | O C THOMAS (SPRING) GARDEN CITY | | | 1100 | | | | | | | PEV | | | | | | PUB |
| 108 | R R THURMAN ROCKLAND COURT | | D | 1105 | 177 | | | | | | CCR CE | | | | | | PUB |
| 109 | UTILITIES SERV CORP GARDEN PARK | 68 | D | 1070 | 325 | | 6 | | 230 | 240 | PCV | 140 | 150 | 16 | 9.37 | 16 | PUB |
| 110 | UTILITIES SERV CORP HUNTING HILLS | 65 | D | 1285 | 470 | 48 | 10 | | 223 | 245 | CS | 230 | 105 | 380 | .27 | 150 | PUB |
| 111 | UTILITIES SERV CORP | 69 | D | | 330 | 90 | 8 | | 210 | 220 | CAMB | 128 | 175 | 28 | 6.25 | 70 | PUB |

VIRGINIA STATE WATER CONTROL BOARD

BUREAU OF WATER CONTROL MANAGEMENT

SUMMARY OF WATER WELL DATA FOR ROANOKE COUNTY

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| SWCB NO | OWNER AND/OR PLACE | YEAR COMP | LOG | ELEV | TOTAL DEPTH | BED-ROCK | CASING MAX | CASING MIN | DEVEL FROM | ZONE TO | AQUIFER | STATIC LEVEL | YIELD | DRAW DOWN | SPEC CAPAC | HRS | USE |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 112 | TOWN OF VINTON | 40 | | 940 | 278 | | 8 | | | | CR | | 470 | 77 | 6.10 | 77 | ABD |
| 113 | TOWN OF VINTON | 66 | D | 980 | 425 | 20 | 8 | | | | CR | 26 | 194 | 324 | .59 | 24 | ABD |
| 115 | WALDRON HOMES | 65 | D | 1020 | 300 | 10 | 6 | | 148 | 150 | OE | 148 | 33 | 64 | .51 | 12 | ABD |
| | BOXLEY HILLS | | | | | | | | | | | | | | | | |
| 116 | WYNDALE WATER CO | 50 | D | 1070 | 125 | | 8 | | | | CR | | | | | | PUB |
| | WESTERN HLS-WYN SUB | | | | | | | | | | | | | | | | |
| 117 | WYNDALE WATER CO | 50 | D | 1190 | 493 | 96 | 8 | | | | CR | 89 | 42 | 58 | .72 | 24 | PUB |
| | WYNDALE SUB | | | | | | | | | | | | | | | | |
| 118 | ROBERT L VIA SUB | | | 1000 | | | | | | | CR | 20 | | | | | PUB |
| 119 | SOUTH SALEM (SPRING) | | | 1100 | | | | | | | CR | | | | | | ABD |
| 120 | AMERICAN VISCOSE CO | 15 | | 910 | 22 | 20 | | | | | CR | 12 | | 60 | | | ABD |
| 121 | AMERICAN VISCOSE CO | 45 | D | 910 | 135 | 20 | 18 | | | | CR | 10 | 900 | 55 | 16.36 | 18 | ABD |
| 122 | AMERICAN VISCOSE CO | | CAB | 910 | | | | | | | SH | | | | | | ABD |
| 123 | AMERCIAN VISCOSE CO | | | 910 | 1100 | | | | | | CR | | | | | | ABD |
| 124 | AMERICAN VISCOSE CO | 36 | D | 960 | 600 | 21 | | | | | CR | | 200 | | | | ABD |
| 125 | AMERICAN VISCOSE CO | 44 | D | 910 | 125 | 21 | 8 | | | | CR | 8 | 825 | 46 | 17.93 | 27 | ABD |
| 126 | AMERCIAN VISCOSE CO | 46 | D | 910 | 167 | 64 | 18 | | | | CR | 8 | 1161 | 36 | 32.25 | 11 | ABD |
| 127 | APPALACHIAN POWER CO | 72 | D | 920 | 405 | 85 | 6 | | 170 | 330 | CR | | 24 | | | 24 | ABD |
| 128 | THOMAS H BEASLEY | 72 | | 1080 | 445 | 40 | 6 | | 185 | 190 | CR | | 10 | | | 3 | IND |
| 129 | THOMAS H BEASLEY | 72 | | 1060 | 265 | 82 | | 50 | 600 | | CR | | | | | 3 | IND |
| 130 | BIOCHEMICAL CORP | 47 | | 1160 | 70 | | | | | | CE | | 600 | | | | IND |
| 131 | CREATIVE PACKAGING | 59 | | 978 | 160 | | 12 | | | | OE | 15 | 525 | 12 | 43.75 | 443 | IND |
| 132 | CREATIVE PACKAGING | 63 | D | 990 | 285 | 70 | 8 | | | | OE | 33 | 300 | 32 | 9.37 | 78 | IND |
| 133 | DOUBLE ENVELOPE CORP | 63 | D | 1130 | 225 | 8 | 6 | | | | DE | 27 | 175 | 200 | .87 | 3 | IND |
| 134 | DR PEPPER BOTTLING CO | | | 960 | 150 | | 4 | | | | CS | 25 | 132 | 47 | 2.80 | | IND |
| 135 | KROGER CO | 58 | D | 1060 | 390 | 38 | 8 | | | | CE | 10 | 235 | 215 | 1.09 | | IND |
| 136 | LEAS & MCVITTY INC | 54 | | 1030 | 325 | | 8 | | | | CE | 22 | 200 | | | | ABD |
| 137 | LEAS & MCVITTY INC | 26 | | 1030 | 500 | | | | | | CE | 9 | | | | | ABD |
| 138 | LEAS & MCVITTY INC | | | 1030 | 275 | | 8 | | | | CE | | 42 | | | | ABD |
| 139 | LIGHTWEIGHT BLOCK CO | 48 | | 1020 | 327 | 3 | 6 | | | | CR | 19 | 12 | 19 | .63 | 1 | IND |
| 140 | OLD DOMINION CANDIES | 56 | | 1080 | 230 | | | | | | CE | | | | | | ABD |
| 141 | ROANOKE ELECTR STEEL | 63 | | 980 | 480 | 35 | 5 | | | | CR | 34 | 100 | 436 | .22 | 1 | IND |
| 142 | ROANOKE MILLS INC | 53 | | 980 | 710 | | 7 | | | | CR | 50 | 100 | 185 | .54 | 12 | IND |
| 143 | SALEM FRAME CO | | | 1120 | 93 | | 6 | | | | ORDOV | | 20 | | | | IND |
| 144 | SALEM FRAME CO | 68 | | 1110 | 105 | | 6 | | | | ORDOV | | 20 | | | | ABD |
| 145 | SALEM FRAME CO | 68 | | 1110 | 165 | | 7 | | 140 | 160 | ORDOV | 12 | 60 | 151 | .39 | 2 | IND |
| 146 | STAUFFER CHEMICAL CO | 37 | D | 900 | 200 | 29 | 8 | | | | OR | 6 | 45 | 145 | .31 | 20 | IND |
| 147 | STAUFFER CHEMICAL CO | 41 | D | 900 | 203 | 16 | 10 | | | | CR | 12 | 283 | 134 | 2.11 | 17 | IND |
| 148 | VALLEY DALE PACKING C | 52 | D | 1020 | 889 | 30 | | | | | CR | 14 | 80 | 131 | .61 | 8 | IND |
| 149 | VALLEY DALE PACKING C | 53 | D | 1080 | 336 | 13 | 10 | | 36 | 87 | CR | 36 | 450 | 76 | 5.92 | 96 | IND |
| 150 | VALLEY LUMBER CORP | | | 960 | 60 | | 6 | | | | CR | 15 | | | | | IND |
| 151 | VIRGINIA BREWING CO | 15 | | 920 | 182 | | 12 | | | | CR | 12 | 360 | 21 | 17.14 | | ABD |
| 152 | VIRGINIA BREWING CO | 15 | CAB | | 400 | | | | | | CR | | | | | | ABD |
| 153 | VIRGINIA PLASTICS CO | 94 | | 1080 | 98 | | 5 | | | | R | 30 | 40 | 80 | .50 | | IND |

V I R G I N I A   S T A T E   W A T E R   C O N T R O L   B O A R D

B U R E A U   O F   W A T E R   C O N T R O L   M A N A G E M E N T

SUMMARY OF WATER WELL DATA FOR ROANOKE COUNTY

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| SWCB NO | OWNER AND/OR PLACE | YEAR COMP | LOG | ELEV | TOTAL DEPTH | BED-ROCK | CASING MAX | CASING MIN | DEVEL FROM | ZONE TO | AQUIFER | STATIC LEVEL | YIELD | DRAW DOWN | SPEC CAPAC | HRS | USE |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 154 | YALE & TOWNE | 59 | D | 950 | 500 | 40 | 16 | 10 | | | CE | 10 | 240 | | | 32 | IND |
| 155 | AERIAL SERVICES CORP | 70 | D | 1000 | 305 | 50 | 6 | | 145 | 150 | PCV | 30 | 30 | | | 6 | COM |
| 156 | ALLSTATE INSURANCE CO | 70 | D | 1230 | 500 | 100 | 8 | | | | CR | 70 | | | | | ABD |
| 157 | CRAIGHEAD WATER CO | 68 | D | 1090 | 490 | 20 | 6 | | 85 | 86 | CR | | 20 | | | | ABD |
| 158 | CRAIGHEAD WATER CO | 71 | D | | 547 | 46 | | | | | | | | | | | ABD |
| 159 | CRAIGHEAD WATER CO | 72 | D | 1240 | 600 | 25 | 10 | 8 | 225 | 226 | OS | | 40 | | | 240 | COM |
| 160 | UTILITIES SERV CORP | 67 | D | 1260 | 450 | 37 | 10 | | 220 | 265 | CR | 70 | 20 | | | | COM |
| 161 | HOTEL ROANOKE | 46 | | 930 | 982 | 11 | | | | | CR | | | | | | ABD |
| 162 | L H & M R CORP | 69 | D | 1020 | 345 | | 6 | | 107 | 108 | CE | | 60 | | | 36 | COM |
| 163 | LOGAN & MCPEAK CORP | 71 | D | 1060 | 185 | | 6 | | 165 | 185 | OMUU | | 10 | | | | COM |
| 164 | C F KEFAVER | 69 | D | 1750 | 295 | 40 | 6 | | 227 | 230 | PCV | | 10 | | | | COM |
| 165 | ROANOKE PHOTO FINISH | 38 | D | 940 | 500 | 15 | 8 | | | | CR | 12 | 145 | | | 26 | COM |
| 166 | SKATADROME | 71 | D | 1030 | 135 | | 6 | | 125 | 135 | CE | | 100 | | | | ABD |
| 167 | STAR INVESTMENTS INC | 54 | | 980 | 131 | | 6 | | | | CR | | | | | | COM |
| 168 | VA ETNA SPRINGS CO | | | | | | | | | | | | | | | | COM |
| 169 | DAYS CONSTRUCTION CO | 72 | | 1100 | 205 | 5 | 6 | | 140 | 145 | OMUU | | 9 | | | 2 | COM |
| 170 | OBSERVATION WELL #8 NELSON-ROANOKE COR | 69 | | 917 | 55 | | 6 | | | | CE | | | | | | GOV |
| 171 | ROANOKE MUNICIPAL BLD | 71 | D | 939 | 203 | 25 | 6 | | | | CE | 25 | 37 | | | 24 | GOV |
| 172 | ROANOKE DRAINAGE WELL | 58 | | 1030 | | | 12 | | | | CE | | | | | | GOV |
| 173 | ROANOKE DRAINAGE WELL | 58 | | 1080 | 76 | | 12 | | | | CE | 65 | | | | | GOV |
| 174 | ROANOKE DRAINAGE WELL | 58 | | 1060 | 25 | | 12 | | | | CE | 22 | | | | | GOV |
| 175 | ROANOKE DRAINAGE WELL | 58 | | 1090 | 78 | | 12 | | | | CE | 60 | | | | | GOV |
| 176 | ROANOKE DRAINAGE WELL | 58 | | 1100 | | | 12 | | | | CE | | | | | | GOV |
| 177 | ROANOKE DRAINAGE WELL | 58 | | 1040 | 112 | | 12 | | | | CE | 38 | | | | | GOV |
| 178 | ROANOKE DRAINAGE WELL | 59 | | 1125 | 76 | | 12 | | | | CE | | 500 | | | | GOV |
| 179 | ROANOKE DRAINAGE WELL | 59 | | 1060 | 91 | | 12 | | | | CE | 77 | | | | | GOV |
| 181 | ROANOKE DRAINAGE WELL | 59 | | 1000 | 107 | | 12 | | | | CE | 28 | | | | | GOV |
| 182 | ROANOKE DRAINAGE WELL | 59 | | 1085 | 113 | | 12 | | | | CE | 71 | | | | | GOV |
| 183 | ROANOKE DRAINAGE WELL | 59 | | 1050 | 59 | | 12 | | | | CE | 58 | 450 | | | | GOV |
| 184 | ROANOKE DRAINAGE WELL | 59 | | 1020 | 103 | | 12 | | | | CE | 39 | | | | | GOV |
| 185 | ROANOKE DRAINAGE WELL | 59 | | 1040 | | | 12 | | | | CE | | 360 | | | | GOV |
| 186 | ROANOKE DRAINAGE WELL | 59 | | 1090 | 68 | | 12 | | | | CE | 66 | 700 | | | | GOV |
| 187 | ROANOKE DRAINAGE WELL | 59 | | 1020 | 69 | | 12 | | | | CE | 36 | 550 | | | | GOV |
| 188 | ROANOKE DRAINAGE WELL | 59 | | 1090 | 136 | | 12 | | | | CE | 78 | 400 | | | | GOV |
| 189 | ROANOKE DRAINAGE WELL | 59 | | 1040 | | | 12 | | | | CE | | | | | | GOV |
| 190 | ROANOKE DRAINAGE WELL | 59 | | 1040 | 106 | | 12 | | | | CE | 38 | 500 | | | | GOV |
| 191 | ROANOKE DRAINAGE WELL | 59 | | 1040 | 124 | | 12 | | | | CE | 34 | 150 | | | | GOV |
| 192 | ROANOKE DRAINAGE WELL | 59 | | 1105 | | | 12 | | | | CE | | | | | | GOV |
| 193 | ROANOKE DRAINAGE WELL | 51 | D | 1930 | 465 | 2 | 10 | | | | OMUU | 10 | 60 | 294 | .20 | 22 | INS |
| 194 | BACK CREEK ELEM SCH | 36 | | 1310 | 58 | | | | | | PCV | 12 | | | | | INS |
| 195 | CLEARBROOK SCHOOL | 39 | | 1240 | 164 | | | | | | PCV | 46 | | | | | INS |
| 196 | CATAWBA SCHOOL | 28 | | 1740 | 107 | | | | | | OMUU | 21 | | | | | INS |
| 197 | CAVE SPRING INT SCH | 55 | | | | | | | | | CR | | | | | | INS |
| 198 | FORT LEWIS SCHOOL | 28 | | 1080 | 99 | | | | | | CE | 27 | 14 | | | | INS |

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V I R G I N I A   S T A T E   W A T E R   C O N T R O L   B O A R D

B U R E A U   O F   W A T E R   C O N T R O L   M A N A G E M E N T

SUMMARY OF WATER WELL DATA FOR ROANOKE COUNTY

| SWCB NO | OWNER AND/OR PLACE | YEAR COMP | LOG | ELEV | TOTAL DEPTH | BED-ROCK | CASING MAX | CASING MIN | DEVEL FROM | ZONE TO | AQUIFER | STATIC LEVEL | YIELD | DRAW DOWN | SPEC CAPAC | HRS | USE |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 199 | GLENVAR COMBINED SCH | 58 | | 1230 | 371 | | | | | | CE | 85 | 50 | | | | INS |
| 200 | MASONS COVE SCHOOL | 61 | | 1285 | 200 | | 6 | | | | DEV | | 25 | | | | INS |
| 201 | MT PLEASANT SCHOOL | 34 | | 1150 | 207 | | | | | | PCV | 29 | | | | | INS |
| 202 | NORTHSIDE INT SCHOOL | 68 | D | 1250 | 332 | 75 | 6 | | 100 | 105 | OE | 38 | 45 | 44 | 1.02 | 24 | INS |
| 203 | NORTHSIDE HIGH SCHOOL | 59 | | 1220 | 149 | 75 | 6 | | | | OE | 31 | | | | | INS |
| 204 | OGDEN RECREATION CNTR | 50 | D | 1140 | 252 | 120 | 6 | | 252 | 253 | CR | 65 | 40 | 110 | .36 | 1 | INS |
| 205 | SOUTHVIEW SCHOOL | 38 | | 1170 | 91 | | | | | | CE | 28 | 36 | | | | INS |
| 206 | VA SYNOD LUTHERAN HOM | 72 | D | 1040 | 185 | 128 | 6 | | 155 | 160 | CR | | 30 | | | 2 | INS |
| 207 | CAVE SPRING RESCUE SQ | 68 | D | 1110 | 320 | 10 | 6 | | | | CS | | 15 | | | 4 | INS |
| 208 | CARL NICHOLS | 50 | D | 1320 | 190 | 92 | 6 | | 158 | 159 | CE | 125 | 8 | | | 3 | ABD |
| 209 | J W DURHAM | 57 | D | 1050 | 353 | 189 | 4 | | 246 | 262 | CR | 121 | 13 | 2 | 6.50 | 5 | DOM |
| 210 | JAMES B FOUTYZ | 64 | D | 1160 | 183 | 76 | 5 | | | | PCV | 124 | | | | | DOM |
| 211 | JAMES R SWEENEY | 64 | D | 1280 | 151 | 25 | 5 | | | | PCV | 52 | | | | | DOM |
| 212 | GEORGE R WEBB | 71 | D | 1040 | 365 | 4 | 6 | | 62 | 63 | PCV | | 4 | | | 8 | DOM |
| 213 | ERNEST E SWEETENBURG | 72 | D | 1180 | 185 | 2 | 6 | | 150 | 155 | OE | | 1 | | | 1 | DOM |
| 214 | J R CANTABERRY | 72 | D | 1440 | 225 | 100 | 6 | | 140 | 145 | OE | | 4 | | | 1 | DOM |
| 215 | MONTEREY HILLS WTR CO | 72 | | 1100 | 93 | | 8 | | 54 | 55 | CE | 12 | 100 | 60 | 1.66 | 53 | PUB |
| 217 | DEMONSTRATION WTR PRJ | 72 | D | 1350 | 605 | 96 | 8 | 6 | 330 | 340 | CS | | 28 | 64 | .43 | 48 | PUB |
| 218 | SOUTHLAND LIFE INSUR | 72 | | 1065 | 100 | | 6 | | 85 | 90 | OMU | | 100 | | | 1 | COM |
| 219 | WILCLAIRE DEVEL CORP | 72 | D | 1400 | 265 | 5 | 6 | | 100 | 105 | SU | | 30 | | | 1 | PUB |
| | LA BELLEVUE SUB | | | | | | | | | | | | | | | | |
| 220 | JAMES LONG CONST CO | 73 | D | 1140 | 430 | 80 | 6 | | 100 | 150 | OE | 213 | 1000 | 23 | 43.47 | 49 | PUB |
| 221 | JAMES LONG CONST CO | 73 | D | 1120 | 520 | 95 | 6 | | 260 | 265 | OE | 228 | 30 | 32 | .93 | 48 | PUB |
| 222 | SEVEN ELEVEN STORE | 73 | D | 1060 | 65 | 5 | 6 | | 55 | 60 | OE | | 12 | | | 2 | COM |
| 223 | CRAIGHEAD WATER CO | 73 | D | 1230 | 209 | 50 | 10 | | 200 | 205 | CS | | 1000 | | | 5 | PUB |
| 224 | R WAYNE COMPTON | 73 | D | 1000 | 105 | 20 | 6 | | 50 | 58 | OE | | 25 | | | 2 | PUB |
| 225 | ROANOKE CO PUB SER AU | 73 | D | 1200 | 265 | 91 | 8 | | 100 | 108 | OE | | 250 | | | 10 | PUB |
| 226 | STRAUSS & BRANCH | 73 | D | 1130 | 205 | | 6 | | 90 | 95 | OE | | 35 | 69 | .50 | 48 | COM |
| 227 | MONTEREY HILLS SUB | 73 | D | 1090 | 350 | 105 | 8 | | 49 | 50 | OE | 80 | 30 | | | | PUB |
| 228 | ROANOKE CO PUB SER | 74 | D | 1140 | 400 | 8 | 8 | | 70 | 75 | OE | | 60 | | | 5 | PUB |
| | AUTHO'ITY-BROOKLAWN | | | | | | | | | | | | | | | | |
| 229 | ROANOKE CO PUB SER | 74 | D | 1160 | 500 | 8 | 6 | | 60 | 65 | OE | | 20 | | | 5 | PUB |
| | AUTHORITY-BROOKLAWN | | | | | | | | | | | | | | | | |
| 230 | F&W COMM DEVEL CORP | 73 | D | 1140 | 385 | 81 | 10 | 8 | 175 | 176 | OE | | 100 | | | | PUB |
| 231 | F&W COMM DEVEL CORP | 73 | D | | 385 | 81 | 8 | | 49 | 50 | OE | | 100 | | | | PUB |
| 232 | DON THOMPSON | 70 | D | 1570 | 465 | 46 | 8 | | 140 | 145 | CR | | 37 | | | 6 | PUB |
| | MCTHOMSON DEV CORP | | | | | | | | | | | | | | | | |
| 233 | ECHOLS CONSTRUCTION | 74 | D | 1010 | 180 | 20 | 6 | | 85 | 90 | CR | | 10 | | | 6 | PUB |
| 234 | CASTLE ROCK WATER CO | 74 | D | 1500 | 485 | 10 | 8 | | 430 | 435 | PCV | | 60 | | | 1 | PUB |
| 235 | LONG RIDGE WATER CO | 74 | D | 1560 | 465 | 40 | 8 | | 324 | 325 | PCV | | 35 | | | 2 | PUB |
| 236 | R L WINE | 73 | | 1090 | 305 | 15 | 10 | | 125 | 130 | OE | | 6 | | | 2 | DOM |
| 238 | QUALITY STATION #25 | | E | 1340 | | | | | | | PCV | | | | | | DOM |
| 239 | QUALITY STATION #26 | | | 1210 | | | | | | | PCV | | | | | | DOM |
| 240 | QUALITY STATION #27 | | | 1090 | | | | | | | PCV | | | | | | DOM |

V I R G I N I A   S T A T E   W A T E R   C O N T R O L   B O A R D

B U R E A U   O F   W A T E R   C O N T R O L   M A N A G E M E N T

SUMMARY OF WATER WELL DATA FOR ROANOKE COUNTY

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| SWCB NO | OWNER AND/OR PLACE | YEAR COMP | LOG | ELEV | TOTAL DEPTH | BED-ROCK | CASING MAX MIN | DEVEL FROM | ZONE TO | AQUIFER | STATIC LEVEL | YIELD | DRAW DOWN | SPEC CAPAC | HRS | USE |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 241 | QUALITY STATION #28 | | | 1100 | | | | | | PCV | | | | | | DOM |
| 242 | NORMAN DUELLETTE | | | 1390 | 120 | | | | | DB | | | | | | DOM |
| 244 | PAUL ROBERTS | | | 1300 | 200 | | | | | DB | | | | | | DOM |
| 245 | RONALD HOGAN SR | | | 1400 | | | | | | DB | | | | | | DOM |
| 246 | STRAUS CONST CO | 72 | | 1120 | | | | | | DE | | | | | | COM |
| 247 | CRAIGHEAD WATER CO | 74 | D | 1300 | 665 | 115 | 10 | 325 | 330 | CR | | 15 | | | 5 | ABD |
| 248 | COUNTY OF ROANOKE | 74 | D | 1880 | 325 | 64 | 6 | 110 | 111 | CE | | 25 | | | 3 | INS |
| 250 | W A MANSPILE | | | 1120 | | | | | | DE | | | | | | DOM |
| 251 | LOCATED AT HOLLINS | | | 1070 | | | | | | OCK | | | | | | DOM |
| 252 | MR WIRTZ | | | 1030 | | | | | | PCV | | | | | | DOM |
| 253 | MRS SHEPERD | | | 1015 | | | | | | PCV | | | | | | DOM |
| 254 | ATLAS POWDER CO | 67 | | 1600 | 143 | | 6 | | | DB | | | | | | IND |
| 255 | JOHN A HALL & CO | | | 1440 | | | | | | CE | | | | | | IND |
| 256 | SALEM STONE CORP | 74 | | 1340 | 350 | | 6 | | | CE | | 4 | | | | IND |
| 257 | MADGE B TWINE | 68 | | 1260 | 135 | 21 | 6 | 120 | 215 | CE | | 30 | | | ? | DOM |
| 258 | AMOS PARPAR | 55 | | 1240 | 55 | | 6 | | | CE | | | | | | DOM |
| 259 | HOUSTON TURNER | | | 1240 | 160 | | 6 | | | CE | | | | | | DOM |
| 260 | C R DAVIDSON TINKER KNOLL #1 | | | | | | | | | | | | | | | DOM |
| 261 | C R DAVIDSON TINKER KNOLL #2 | | | | | | | | | | | | | | | DOM |
| 262 | R & J WATER CORP | 70 | | | 125 | | | | | | | 26 | | | | PUB |
| 263 | JAMES LONG CONST CO | 73 | | 1060 | 270 | 52 | 6 | 170 | 175 | OE | 94 | 100 | 17 | 5.88 | 88 | PUB |
| 265 | EDGEWOOD WATER CO #5 | 68 | | 1040 | 350 | | 6 | | | CE | | 30 | | | | PUB |
| 266 | EDGEWOOD WATER CO | 68 | | 1160 | | | | | | CE | | | | | | PUB |
| 267 | W O JAMES | 56 | | 1100 | 132 | | 6 | | | DE | | | | | | PUB |
| 268 | C W POFF & SON | 70 | | 1280 | 248 | 60 | 6 | 140 | 231 | CE | 103 | 20 | 140 | .14 | 30 | PUB |
| 269 | BLUE RIDGE COMPLEX | 66 | | 1000 | 165 | | 6 | 85 | 90 | CR | 160 | 12 | | | 2 | PUB |
| 270 | ROANOKE CO PSA | | | 1110 | | | | | | DB | 95 | 19 | 377 | .05 | | PUB |
| 271 | QUALITY STATION GW79 | | | 1720 | | | | | | PCV | | | | | | DOM |
| 273 | ROANOKE CO PSA | 75 | | 1210 | 600 | | | | | CR | 95 | 19 | 377 | .05 | | PUB |
| 274 | VIEW POINT HEIGHTS WATFR CO #1 | | | | 206 | | 6 | | | | | | | | | PUB |
| 275 | VIEW POINT HEIGHTS WATER CO #2 | | | | 312 | | 6 | | | | | | | | | PUB |
| 276 | VA BAPTIST CHILDRENS HOME | 35 | | 1230 | 1253 | | | | | OMUU | | 14 | | | | INS |
| 277 | B R STACEY | 69 | | 1180 | 180 | | 6 | | | CE | 90 | 50 | | | | DOM |
| 278 | TANGLEWOOD SOUTH #1 | 73 | | | 430 | | | | | CS | | 70 | | | | COM |
| 279 | TANGLEWOOD SOUTH #2 | | | | | | | | | | | | | | | ABD |
| 280 | SUNCREST WATER CO | | | 1140 | 104 | | 8 | | | PCV | 50 | 35 | 10 | 3.50 | | PUB |
| 281 | SOUTHERN RVRAL WATER SYSTEMS INC | | | | 480 | | 6 | | | | | 26 | | | | PUB |
| 282 | RONNIE-SHERRY WTR CO | 60 | | | 408 | | | | | | | 50 | 100 | .50 | | PUB |

VIRGINIA STATE WATER CONTROL BOARD

BUREAU OF WATER CONTROL MANAGEMENT

SUMMARY OF WATER WELL DATA FOR ROANOKE COUNTY

| SWCB NO | OWNER AND/OR PLACE | YEAR COMP | LOG | ELEV | TOTAL DEPTH | BED-ROCK | CASING MAX | CASING MIN | DEVEL FROM | ZONE TO | AQUIFER | STATIC LEVEL | YIELD | DRAW DOWN | SPEC CAPAC | HRS | USE |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 283 | MR JR LAPRADE | | | 1110 | 265 | | 6 | | | | CE | 25 | 13 | | | | DOM |
| 284 | ROANOKE SANITARY DISP | 75 | D | 1120 | 175 | 40 | 10 | 8 | | | CS | | 30 | | | | IND |
| 285 | DARELL F BRANSTETTER | 75 | D | 1600 | 230 | 105 | 6 | | | | PCV | | 27 | | | | IND |
| 287 | ACORN CONST CO | 75 | D | 1740 | 110 | 30 | 6 | | 1 | 60 | CE | | 30 | | | | PUB |
| 288 | CRAIGHEAD WATER CO | 74 | D | 1300 | 505 | | 10 | | | | | 120 | 40 | 30 | 1.33 | | PUB |
| 295 | W B BRICKLEY | 72 | | 1050 | | | | | | | CE | | | | | | DOM |
| 296 | R O BRICKLEY | 72 | | 1050 | | | | | | | CE | | | | | | DOM |
| 297 | R G BURNLEY SPRING | | | 980 | | | | | | | PCV | | 5 | | | | DOM |
| 298 | DANIEL E GRYDER | 75 | D | 1580 | 265 | 30 | 6 | | 90 | 91 | PCV | | 2 | | | 3 | DOM |
| 299 | THOMAS BROS INC | 75 | D | 1520 | 385 | 3 | 6 | | 330 | 331 | CE | | 12 | | | 2 | PUB |
| 300 | G CLARENCE HARTMAN | 75 | D | 1110 | 245 | 50 | 6 | | 100 | 101 | PCV | | 2 | | | 2 | DOM |
| 301 | WARD MOBILE HOME SALE | 75 | D | 2840 | 85 | 5 | 6 | | 55 | 56 | PCV | | 2 | | | 2 | COM |
| 302 | BRIDLEWOOD ASSOCIATES | 75 | D | | 285 | 15 | | | | | PCV | | | | | | ABD |
| 303 | BRIDLEWOOD ASSOCIATES | 75 | D | | 385 | 30 | | | | | PCV | | | | | | ABD |
| 304 | BRIDLEWOOD ASSOCIATES | 75 | D | | 405 | 20 | | | | | PCV | | 6 | | | 5 | ABD |
| 305 | G THOMAS KING JR | 75 | D | 1460 | 185 | 8 | 6 | | 65 | 66 | PCV | | 4 | | | 2 | DOM |
| 306 | ROY CARTER | 75 | D | 1060 | 145 | 11 | 6 | | | | CR | | 11 | | | 2 | DOM |
| 307 | VA POLYTECHNIC INST | 75 | D | 1720 | 305 | 12 | 6 | | 225 | 226 | OE | | 150 | | | 4 | INS |
| 309 | CASTLE ROCK H20 CO | | | 1280 | 485 | | 6 | | | | | | 60 | | | | PUB |
| 310 | ELI LILLY | 65 | | 980 | 275 | | 6 | | | | | 33 | 300 | 67 | 4.47 | | IND |
| 311 | ISAAC SUTPHIN | 68 | | 1080 | 283 | | 4 | | | | | 23 | 19 | | | 6 | IND |
| 312 | JAMES E BUCKLAND | | | 1160 | 143 | | 6 | | | | | | 50 | | | | IND |
| 313 | ROBERT S RADER | | | 1100 | 250 | | 6 | | | | | | 80 | | | | DOM |
| 314 | SKATADROME | | | 1040 | 135 | | 6 | | | | | | 100 | | | | PUB |
| 315 | C & P TELEPHONE CO | 57 | | 1100 | 262 | | 6 | | | | | 35 | 8 | 37 | .21 | | PUB |
| 316 | STATEMAN INDUSTRIAL | 74 | | 1060 | 285 | | 6 | | | | | 35 | 65 | 65 | 1.00 | 9 | DOM |
| 317 | BEN DUNFORD | | | 1220 | | | | | | | | | | | | | DOM |
| 318 | PAUL W MCDANIEL | | | 1780 | | | | | | | | | | | | | DOM |
| 319 | LAWRENCE C ALLS | | | 1960 | | | | | | | | | | | | | DOM |
| 320 | CLAUDE M GARMAN | | | 1840 | | | | | | | | | | | | | DOM |
| 321 | ELDRED FRANCISCO | 53 | | 1940 | 48 | | 6 | | | | | 15 | 5 | | | | DOM |
| 323 | BLUE HILLS GOLF COURS | 67 | | 1080 | 375 | | 6 | | | | | | 300 | | | | DOM |
| 324 | CRAIGHEAD WATER CO | 74 | | 1180 | 505 | | 6 | | | | | 120 | 40 | | | | DOM |
| 325 | HURBERT CROOK CENTER | | | 1150 | 85 | | 6 | | | | | | 50 | | | | DOM |
| 326 | L W BOITNOTT | | | 1160 | 165 | | 6 | | | | | | 50 | | | | DOM |
| 327 | FRANK H JOHNSON | | | 1140 | 85 | | 6 | | | | | | 30 | | | | DOM |
| 328 | WALDRON FARMS | | | 1080 | | | | | | | | | | | | | DOM |
| 329 | E L MULLINS | | | 1200 | 148 | | 6 | | | | | | 35 | | | | DOM |
| 330 | C A ASSAID | | | 1280 | 140 | | | | | | | 77 | | 12 | | | DOM |
| 331 | FRANK SCHILLIAT | | | 1200 | | | | | | | | | | | | | DOM |
| 332 | LOCK HAVEN CO CLUB | | | 1240 | | | | | | | | | | | | | DOM |
| 335 | DAVID HAMBLIN | 72 | | 1040 | 160 | | 6 | | | | | 30 | 60 | | | | DOM |
| 336 | D T RADER | 66 | | 1000 | 70 | | 6 | | | | | | | | | | DOM |
| 337 | FOUTZ | 00 | | 1000 | 12 | | 36 | | | | | 6 | 5 | | | | DOM |

V I R G I N I A   S T A T E   W A T E R   C O N T R O L   B O A R D

B U R E A U   O F   W A T E R   C O N T R O L   M A N A G E M E N T

SUMMARY OF WATER WELL DATA FOR ROANOKE COUNTY

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| SWCB NO | OWNER AND/OR PLACE | YEAR COMP | LOG | ELEV | TOTAL DEPTH | BED-ROCK | CASING MAX MIN | DEVEL FROM | ZONE TO | AQUIFER | STATIC LEVEL | YIELD | DRAW DOWN | SPEC CAPAC | HRS | USE |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 338 | E R GIBSON | 59 | | 2000 | 300 | | 6 | | | | 40 | 10 | | | | DOM |
| 339 | HENRY FLIPPEN | 67 | | 980 | 64 | | 6 | | | | 52 | 5 | | | | DOM |
| 340 | W T CARTER | 75 | D | | 252 | | 5 | | | | 202 | 10 | 43 | .23 | | DOM |
| 341 | BILL BAILEY | 75 | D | | 59 | | 5 | | | | 10 | 10 | 30 | .33 | | DOM |
| 342 | STATE STONE COMPANY | | | | | | | | | | | | | | | DOM |
| 343 | PINE MTN WATER CO INC | | | | | | | | | | | | | | | DOM |
| 344 | EATON CORPORATION | | | | | | | | | | | | | | | DOM |
| 345 | CHARLES R SIMPSON | 75 | D | | 182 | 160 | 6 | | | | 40 | 8 | | | 2 | DOM |
| 346 | ROANOKE C PUBLIC SEP | 75 | D | | 225 | | 10 | | | | 30 | 100 | 60 | 1.66 | 10 | COM |
| 347 | HAROLD W BILLINGS | 75 | D | | 345 | 55 | 6 | | | | | 1 | | | 2 | DOM |
| 348 | BRIDLEWOOD ASSOC | 75 | D | | 405 | 80 | 8 | | | | | 30 | | | 4 | COM |
| 349 | BRIDLEWOOD ASSOC | 75 | D | | 405 | 50 | | | | | | 6 | | | 5 | COM |
| 350 | OLD DOMINION HOMES | 75 | D | | 265 | 225 | 6 | | | | | 1 | | | 3 | DOM |
| 351 | C C BERNARD | 75 | D | | 165 | | 6 | | | | | 50 | | | 2 | DOM |
| 352 | OLD DOMINION HOMES | 75 | D | | 125 | | 6 | | | | | 6 | | | 2 | DOM |
| 353 | OLD DOMINION HOMES | 75 | D | | 125 | | 6 | | | | | 7 | | | 2 | DOM |
| 354 | FIFTH PLANNING DIST | 75 | D | | 205 | | 6 | | | | | 5 | | | 2 | DOM |
| 355 | FIFTH PLANNING DIST | 75 | D | | 50 | 13 | 6 | | | | | 1 | | | 1 | DOM |
| 356 | FIFTH PLANNING DIST | 75 | | | 100 | | 6 | | | | | 50 | | | 1 | DOM |
| 357 | FIFTH PLANNING DIST | 75 | D | | 240 | | 6 | | | | | 100 | | | 2 | DOM |
| 358 | BOWMAN & BOWMAN CONTR | 75 | D | | 165 | 75 | 6 | | | | | 2 | | | 2 | DOM |
| 359 | BILL BRICKLY | 75 | D | | 177 | | 6 | | | | 35 | 10 | 90 | .11 | 1 | DOM |
| 360 | BILL BRICKLY | 73 | D | | 200 | | 6 | | | | 90 | 10 | 60 | .16 | 1 | DOM |
| 361 | ROANOKE DRAINAGE WELL | | | 1080 | 76 | | | | | | 65 | | | | | DOM |
| 362 | ROANOKE DRAINAGE WELL | | | 1035 | 170 | | | | | | 28 | 790 | | | | DOM |
| 363 | ROANOKE DRAINAGE WELL | | | 1060 | 90 | | | | | | 67 | 450 | | | | DOM |
| 364 | ROANOKE DRAINAGE WELL | | | 1000 | | | | | | | | | | | | DOM |
| 365 | ROANOKE DRAINAGE WELL | | | 1040 | 60 | | | | | | 45 | 450 | | | | DOM |
| 366 | ROANOKE DRAINAGE WELL | | | 1090 | 107 | | | | | | 75 | 450 | | | | DOM |
| 367 | ROANOKE DRAINAGE WELL | | | 1080 | 107 | | | | | | 64 | 300 | | | | DOM |
| 368 | ROANOKE DRAINAGE WELL | | | 1020 | 82 | | | | | | 49 | 440 | | | | DOM |
| 369 | ROANOKE DRAINAGE WELL | | | 1020 | 201 | | | | | | 41 | | | | | DOM |
| 370 | ROANOKE DRAINAGE WELL | | | 1090 | 74 | | | | | | 68 | 600 | | | | DOM |
| 371 | ROANOKE DRAINAGE WELL | | | 1040 | 170 | | | | | | 37 | 300 | | | | DOM |
| 372 | ROANOKE DRAINAGE WELL | | | 1060 | 33 | | | | | | 32 | | | | | DOM |
| 373 | ROANOKE DRAINAGE WELL | | | 1040 | 115 | | | | | | 29 | 200 | | | | DOM |
| 374 | ROANOKE DRAINAGE WELL | | | 1100 | 120 | | | | | | 63 | 350 | | | | DOM |
| 375 | ROANOKE DRAINAGE WELL | | | 1015 | | | | | | | | | | | | DOM |
| 376 | ROANOKE DRAINAGE WELL | | | 1040 | | | | | | | 27 | 50 | | | | DOM |
| 377 | ROANOKE DRAINAGE WELL | | | 1090 | 178 | | | | | | 75 | 450 | | | | DOM |
| 378 | ROANOKE DRAINAGE WELL | | | 1115 | 168 | | | | | | 72 | 200 | | | | DOM |
| 379 | ROANOKE DRAINAGE WELL | | | 1100 | 107 | | | | | | 96 | 380 | | | | DOM |
| 380 | ROANOKE DRAINAGE WELL | | | 1100 | 77 | | | | | | 73 | 400 | | | | DOM |
| 381 | ROANOKE DRAINAGE WELL | | | 1105 | 92 | | | | | | 78 | 520 | | | | DOM |

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B U R E A U   O F   W A T E R   C O N T R O L   M A N A G E M E N T

SUMMARY OF WATER WELL DATA FOR ROANOKE COUNTY

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|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 382 | ROANOKE DRAINAGE WELL | | | 1105 | 112 | | | | | | 62 | 490 | | | | DOM |
| 383 | ROANOKE DRAINAGE WELL | | | 1020 | 72 | | | | | | 56 | 330 | | | | DOM |
| 384 | ROANOKE DRAINAGE WELL | | | 1155 | | | | | | | | | | | | DOM |
| 385 | ROANOKE DRAINAGE WELL | | | 1050 | 82 | | | | | | 72 | 510 | | | | DOM |
| 386 | ROANOKE DRAINAGE WELL | | | 1050 | 57 | | | | | | 46 | 500 | | | | DOM |
| 387 | ROANOKE DRAINAGE WELL | | | 1080 | | | | | | | | | | | | DOM |
| 388 | ROANOKE DRAINAGE WELL | | | 1105 | 98 | | | | | | 73 | 400 | | | | DOM |
| 389 | ROANOKE DRAINAGE WELL | | | 1050 | | | | | | | | 520 | | | | DOM |
| 390 | ROANOKE DRAINAGE WELL | | | 1100 | | | | | | | | 40 | | | | DOM |
| 391 | ROANOKE DRAINAGE WELL | | | 1080 | | | | | | | | 517 | | | | DOM |
| 392 | ROANOKE DRAINAGE WELL | | | 1080 | | | | | | | | 472 | | | | DOM |
| 393 | ROANOKE DRAINAGE WELL | | | 1040 | | | | | | | | 80 | | | | DOM |
| 394 | ROANOKE DRAINAGE WELL | | | 1080 | | | | | | | | 250 | | | | DOM |
| 395 | ROANOKE DRAINAGE WELL | | | 1035 | | | | | | | | 300 | | | | DOM |
| 396 | ROANOKE DRAINAGE WELL | | | 1100 | | | | | | | | 650 | | | | DOM |
| 397 | ROANOKE DRAINAGE WELL | | | 1085 | | | | | | | | 730 | | | | DOM |
| 398 | ROANOKE DRAINAGE WELL | | | 1050 | | | | | | | | | | | | DOM |
| 399 | ROANOKE DRAINAGE WELL | | | 1050 | | | | | | | | 200 | | | | DOM |
| 400 | ROANOKE DRAINAGE WELL | | | 1040 | | | | | | | | 155 | | | | DOM |
| 401 | ROANOKE DRAINAGE WELL | | | 1050 | | | | | | | | | | | | DOM |
| 402 | ROANOKE DRAINAGE WELL | | | 1050 | | | | | | | | 55 | | | | DOM |
| 403 | ROANOKE DRAINAGE WELL | | | 995 | | | | | | | | | | | | DOM |
| 404 | ROANOKE DRAINAGE WELL | | | 1035 | | | | | | | | 25 | | | | DOM |
| 405 | ROANOKE DRAINAGE WELL | | | 1035 | | | | | | | | | | | | DOM |
| 406 | ROANOKE DRAINAGE WELL | | | 1060 | | | | | | | | 450 | | | | DOM |
| 407 | ROANOKE DRAINAGE WELL | | | 1070 | | | | | | | | 450 | | | | DOM |
| 408 | ROANOKE DRAINAGE WELL | | | 1070 | | | | | | | | 400 | | | | DOM |
| 409 | ROANOKE DRAINAGE WELL | | | 1085 | | | | | | | | 400 | | | | DOM |
| 410 | ROANOKE DRAINAGE WELL | | | 1100 | | | | | | | | | | | | DOM |
| 411 | ROANOKE DRAINAGE WELL | | | 1070 | | | | | | | | | | | | DOM |
| 412 | ROANOKE DRAINAGE WELL | | | 1080 | | | | | | | | 400 | | | | DOM |
| 413 | ROANOKE DRAINAGE WELL | | | 1090 | | | | | | | | | | | | DOM |
| 414 | ROANOKE DRAINAGE WELL | | | 1035 | | | | | | | | | | | | DOM |
| 415 | ROANOKE DRAINAGE WELL | | | 1050 | | | | | | | | 350 | | | | DOM |
| 416 | ROANOKE DRAINAGE WELL | | | 1040 | | | | | | | | | | | | DOM |
| 417 | ROANOKE DRAINAGE WELL | | | 1050 | | | | | | | | | | | | DOM |
| 418 | ROANOKE DRAINAGE WELL | | | 1035 | | | | | | | | | | | | DOM |
| 419 | ROANOKE DRAINAGE WELL | | | 1090 | | | | | | | | | | | | DOM |
| 420 | ROANOKE DRAINAGE WELL | | | 1040 | | | | | | | | | | | | DOM |
| 421 | ROANOKE DRAINAGE WELL | | | 1040 | | | | | | | | | | | | DOM |
| 422 | ROANOKE DRAINAGE WELL | | | 1040 | | | | | | | | | | | | DOM |
| 423 | ROANOKE DRAINAGE WELL | | | 1090 | | | | | | | | | | | | DOM |
| 424 | ROANOKE DRAINAGE WELL | | | 1040 | | | | | | | | | | | | DOM |
| 425 | ROANOKE DRAINAGE WELL | | | 1080 | | | | | | | | | | | | DOM |

V I R G I N I A   S T A T E   W A T E R   C O N T R O L   B O A R D

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|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 426 | ROANOKE DRAINAGE WELL | | | 1140 | | | | | | | | | | | | DOM |
| 427 | ROANOKE DRAINAGE WELL | | | 1050 | | | | | | | | | | | | DOM |
| 428 | ROANOKE DRAINAGE WELL | | | 1075 | | | | | | | | | | | | DOM |
| 429 | ROANOKE DRAINAGE WELL | | | 1050 | | | | | | | | | | | | DOM |
| 430 | ROANOKE DRAINAGE WELL | | | 1040 | | | | | | | | | | | | DOM |
| 431 | ROANOKE DRAINAGE WELL | | | 1040 | | | | | | | | | | | | DOM |
| 432 | ROANOKE DRAINAGE WELL | | | 1050 | | | | | | | | | | | | DOM |
| 433 | ROANOKE DRAINAGE WELL | | | 1050 | | | | | | | | | | | | DOM |
| 434 | ROANOKE DRAINAGE WELL | | | 1060 | | | | | | | | | | | | DOM |
| 435 | ROANOKE DRAINAGE WELL | | | 1070 | | | | | | | | | | | | DOM |
| 436 | ROANOKE DRAINAGE WELL | | | 1080 | | | | | | | | | | | | DOM |
| 437 | ROANOKE LOOKOUT MOTEL | | | 2580 | | | | | | | | 5 | | | | DOM |
| 438 | PAUL GRAYBEAL | 07 | | 1340 | 160 | | 6 | | | | | 20 | | | | DOM |
| 439 | R D WRAY | 75 | D | | 105 | 21 | 6 | | | | 20 | 8 | | | | DOM |
| 440 | MICHAEL HOLLAND | 75 | D | | 250 | 21 | 6 | | | | 30 | 2 | | | | DOM |
| 441 | D J HIGGINBOTHAM | 75 | D | | 325 | 35 | 6 | | | | | 5 | | | 2 | DOM |
| 442 | ARTHUR E SMITH | 75 | D | | 105 | | 6 | | | | | 10 | | | 2 | DOM |
| 443 | H B DEACON WELL DRILL | 75 | D | | 265 | | 6 | | | | | 6 | | | 1 | DOM |
| 444 | L H SAWYER PAVING | 75 | D | | 205 | | 6 | | | | | 6 | | | 4 | DOM |
| 445 | MRS VADA CHAMBERS | 75 | D | | 245 | 130 | 6 | | | | | 1 | | | 3 | DOM |
| 446 | E R DOYLE | 75 | D | | 305 | | 6 | | | | | 15 | | | 2 | DOM |
| 447 | J M TURNER INC | 75 | D | | 165 | | 6 | | | | | 25 | | | 1 | DOM |
| 448 | CLINTON TROUT JR | 75 | D | | 105 | 85 | 6 | | | | | 12 | | | 2 | DOM |
| 449 | ROANOKE PUB SER AUTHO | 76 | D | | 425 | | 8 | | | | | 40 | | | 2 | COM |
| 450 | NO NAME | 75 | D | | 170 | | | | | | 40 | 15 | | | | DOM |

## GLOSSARY

| | |
|---|---|
| Alluvium | A general term for sediments deposited in recent geological time by a stream or other body of water. |
| Anticline | An upfold of layered rocks in the form of an arch and having the oldest strata in the center. The reverse of a syncline. |
| Aquiclude | A geologic formation, group of formations or part of formations that does not have enough permeability to supply appreciable quantities of water. |
| Aquifer | A geologic formation, group of formations or part of formations that is capable of supplying water to wells in usable quantities. An aquifer is unconfined (water table conditions), or confined (artesian conditions) depending on whether the groundwater level is at atmospheric pressure, or greater than atmospheric pressure due to the presence of an overlying confining geologic formation (aquiclude). |
| Aquifer System | A group of inter-related aquifers. |
| Artesian Well | A well in which the water rises under artesian pressure above the top of the aquifer the well penetrates, but does not necessarily reach the land surface. |
| Bedding Plane | The diversion plane in sedimentary or stratified rocks which separates the individual layers, beds or strata. |
| Bedrock | Any solid rocks exposed at the surface or overlain by unconsolidated materials. |
| Breccia | General term for a rock of any origin containing angular particles. |
| Carbonate Rock | A rock consisting chiefly of carbonate minerals, such as limestone, dolomite. |
| Clastic Rock | A consolidated sedimentary rock composed of broken fragments that are derived from pre-existing rocks, e.g. sandstone, conglomerate, or shale, etc. |
| Colluvium | Loose soil material and/or rock fragments deposited by the action of gravity, usually at the base of a slope or cliff. |

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|---|---|
| Consolidated | A rock that is firm and rigid in nature due to the natural interlocking and/or cementation of its mineral grain components. The reverse is unconsolidated. |
| Cross-Section | A diagram or drawing that shows features transected by a given plane; e.g. geologic feature such as geologic structure. |
| Dip | The angle at which a rockbed is inclined from the horizontal. |
| Dolomite | A sedimentary rock composed of calcium and magnesium carbonate. |
| Drawdown | The difference between static level and pumping level in a well, i.e. the drop in the water level due to pumping. |
| Evapotranspiration | The process by which surface water, soils and plants release water vapor to the air. |
| Fault | A fracture or fracture zone along which there has been movement of two rock masses relative to one another parallel to the fracture. The movement may be a few inches or many miles, horizontal or vertical. |
| Fissile | An adjective describing rocks that split along closely spaced parting planes. |
| Flood Plain | The strip of relatively smooth land adjacent to a river channel and built of alluvium carried by the river during floods. The flood plain is covered by water when the river is in flood. |
| Fold | A bend in the rock strata. |
| Formation | A unit of geologic mapping consisting of some one kind of rock. |
| Fracture | Break in rocks. |
| Granite | A coarse-grained igneous rock consisting of feldspar, quartz, and other minerals. |
| Groundwater | Water below the water table, i.e. in the zone of saturation. |
| Igneous Rocks | Rocks formed by solidification of deep-seated molten silicate materials. |
| Infiltration | The flow of water through the soil surface into the ground. |

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|---|---|
| Joint | A fracture in rock along which no appreciable movement has occurred. Joints are generally perpendicular to bedding planes. |
| Karst | A terrain, generally underlain by limestone in which the topography is chiefly formed by the dissolution of rock and which is commonly characterized by closed depressions (sinkholes) and caves. |
| Limestone | A sedimentary rock consisting predominately of calcium carbonate. |
| Lithology | The composition and structure of rock. Adjective: Lithologic |
| Metamorphic Rocks | Rocks formed within the earth crust by the transformation of a pre-existing rock in the solid state without fusion and without addition of new material, as a result of high temperatures, high pressures, or both. |
| Permeability | The capacity of a rock or soil for transmitting water. |
| Porosity | The spaces or voids in rock and soil materials usually expressed as a percentage of the material. |
| Potentiometric Surface | The level to which groundwater rises in a well or an aquifer (in a water table or unconfined aquifer, it is the water table; in an artesian or confined aquifer, it is the piezometric surface, also called artesian head: water level above the top of the penetrated aquifer). |
| Quartzite | A very hard but unmetamorphosed sandstone. |
| Recharge | The addition of water to an aquifer by natural infiltration or artificial means. |
| Runoff | That part of precipitation that appears in surface streams. |
| Sandstone | Sedimentary rock consisting predominately of sand-size particles. |
| Schist | A well-foliated metamorphic rock in which the component flaky materials (mica) are distinctly visible. |
| Sedimentary Rocks | Refers to rocks formed from the consolidation of layered sediments that have accumulated in water. |

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|---|---|
| Sinkhole | A funnel-shaped depression in the land surface, usually in a limestone region, developed by dissolving action of water and usually connected with underlying solution channels or cavities. |
| Slate | A metamorphic rock formed by the metamorphism of shale. |
| Structure | The general disposition, attitude, arrangement, or relative positions of the rock masses of a region or area, also referred to as "structural geology". |
| Subsidence | A local mass movement that involves principally the gradual downward settling or sinking of the earth's surface. |
| Syncline | A downfold with troughlike forms and having youngest rock in the center. |
| Terrace Deposits | Deposits of alluvium (sand, gravel, cobble or clay) which occurs along the margin and above the level of a body of water, marking a former water level. |
| Topography | The relief and form of a land surface. |
| Water Table | The upper surface of the zone of saturation. The surface in water table aquifer at which the water level stands. |
| Water Well | An artificial excavation (pit, hole, tunnel) generally cylindrical in form and often walled in, sunk (drilled, dug, driven, bored, jetted) into the ground to such a depth as to penetrate water-yielding rock and to allow water to flow or to be pumped to the surface. |

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## VIRGINIA STATE WATER CONTROL BOARD
**P. O. Box 1143, 2111 North Hamilton Street**
**Richmond, Virginia 23230**
**(804) 786-1411**

1 **Southwestern Regional Office**
408 East Main Street
P. O. Box 976
Abingdon, VA 23210
(703) 628-5183

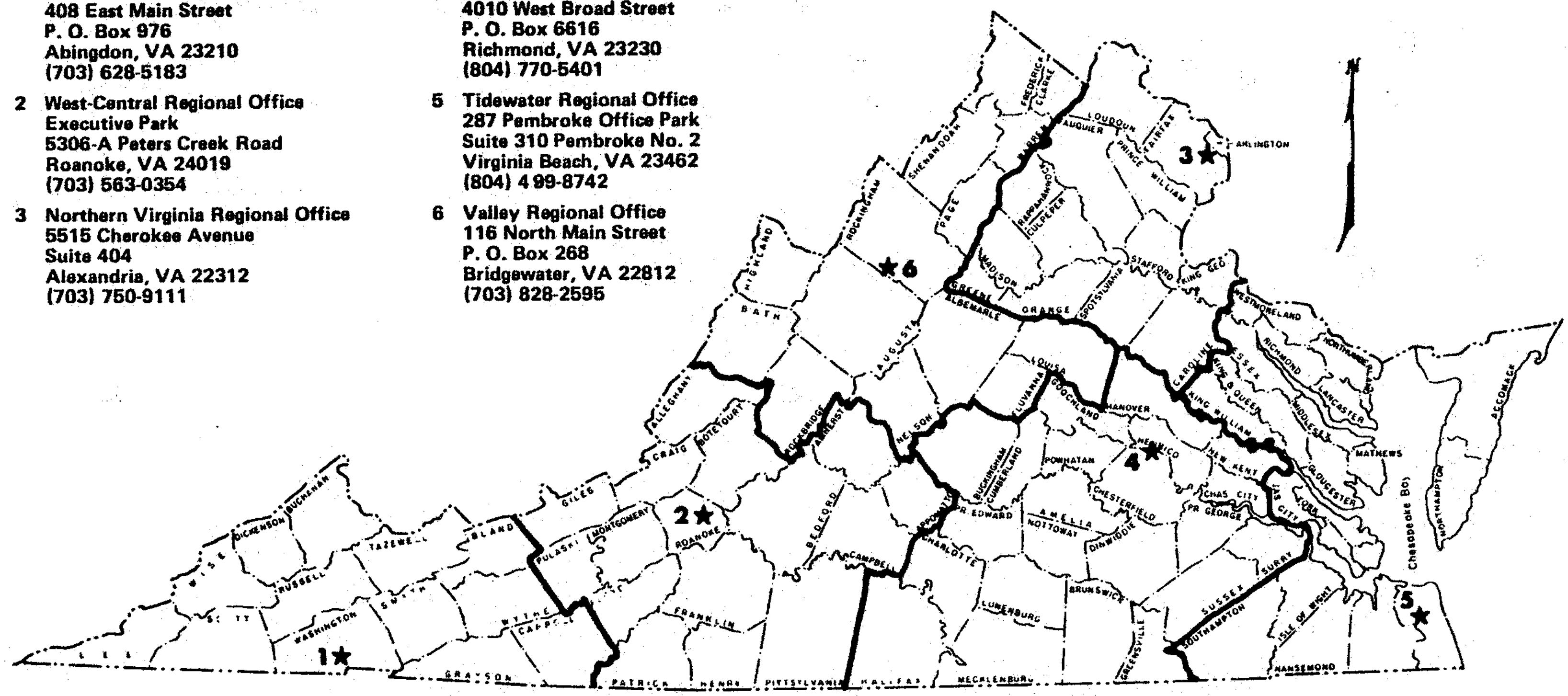
2 **West-Central Regional Office**
Executive Park
5306-A Peters Creek Road
Roanoke, VA 24019
(703) 563-0354

3 **Northern Virginia Regional Office**
5515 Cherokee Avenue
Suite 404
Alexandria, VA 22312
(703) 750-9111

4 **Piedmont Regional Office**
4010 West Broad Street
P. O. Box 6616
Richmond, VA 23230
(804) 770-5401

5 **Tidewater Regional Office**
287 Pembroke Office Park
Suite 310 Pembroke No. 2
Virginia Beach, VA 23462
(804) 499-8742

6 **Valley Regional Office**
116 North Main Street
P. O. Box 268
Bridgewater, VA 22812
(703) 828-2595




Source: Virginia State Water Control Board — BWCM

PLATE NO. 12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